
Meridian 1

Nortel COMPANION Microcellular

Installation guide

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Introduction to the Microcellular system

The Nortel COMPANION Microcellular system provides both in-building and wide area mobility, using a single, standard cellular portable. The Microcellular system is fully integrated within a Meridian 1 system, so users have access to a number of popular Meridian 1 features on their portables while in-building.

The Microcellular system supports the IS-136 and IS-54B radio protocols. A Release 23 system supports TDMA-3 ACELP (Algebraic Code Excited Linear Predictive), a method of implementing EFRC (Enhanced Full Rate Codec) in IS-136 systems. ACELP implements the IS-641 protocol to provide toll-line voice quality. A Microcellular system can also use VSELP (Vector Sum Excited Linear Predictive) for voice encoding.

Figure 1 gives an overview of Microcellular components for Option 51C, 61C, 81, and 81C systems.

Figure 2 illustrates the hardware components of a Microcellular system with a serial connection to an AFP Station.

Figure 1
Microcellular system model (Options 51C, 61C, 81, and 81C)

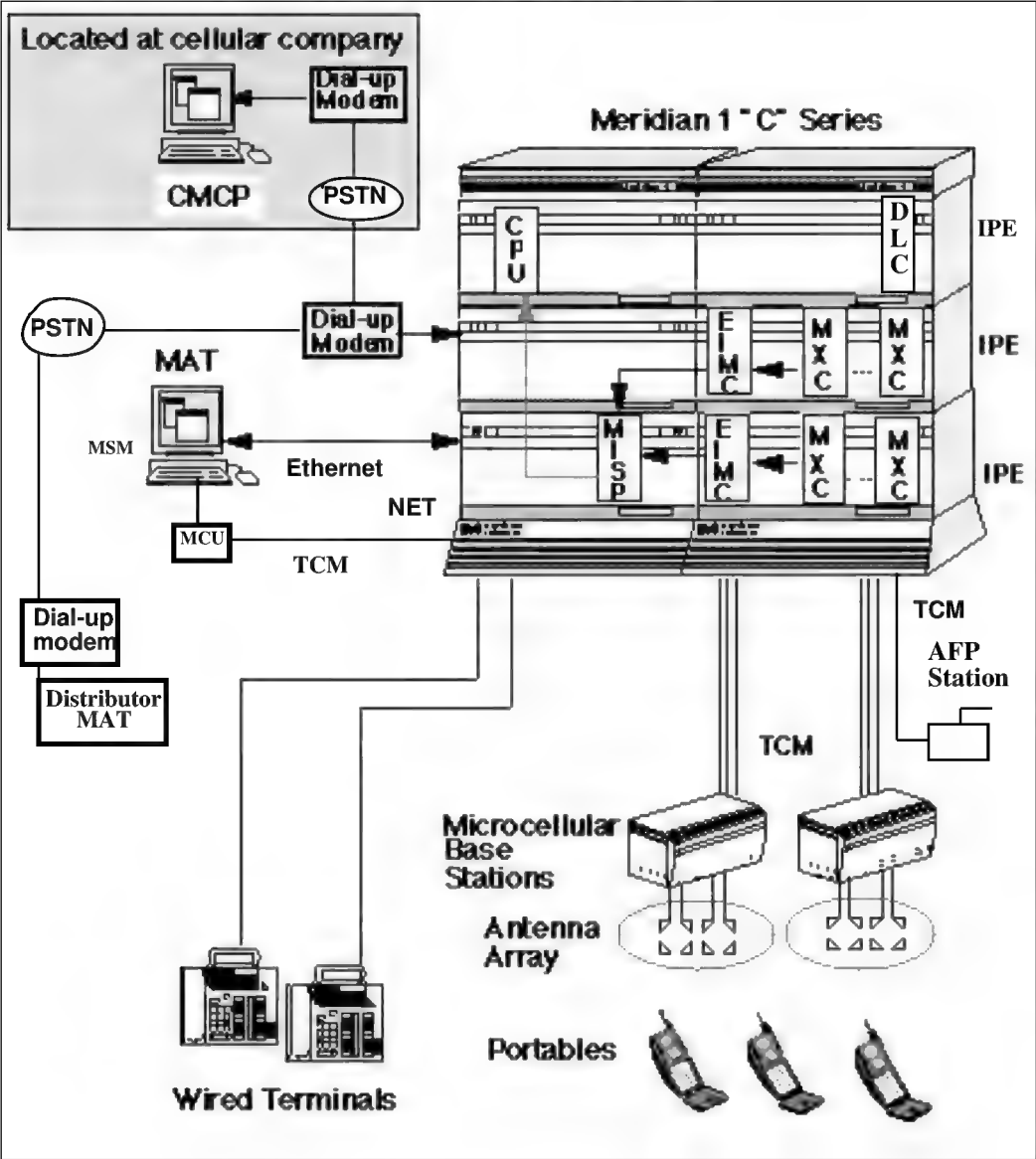
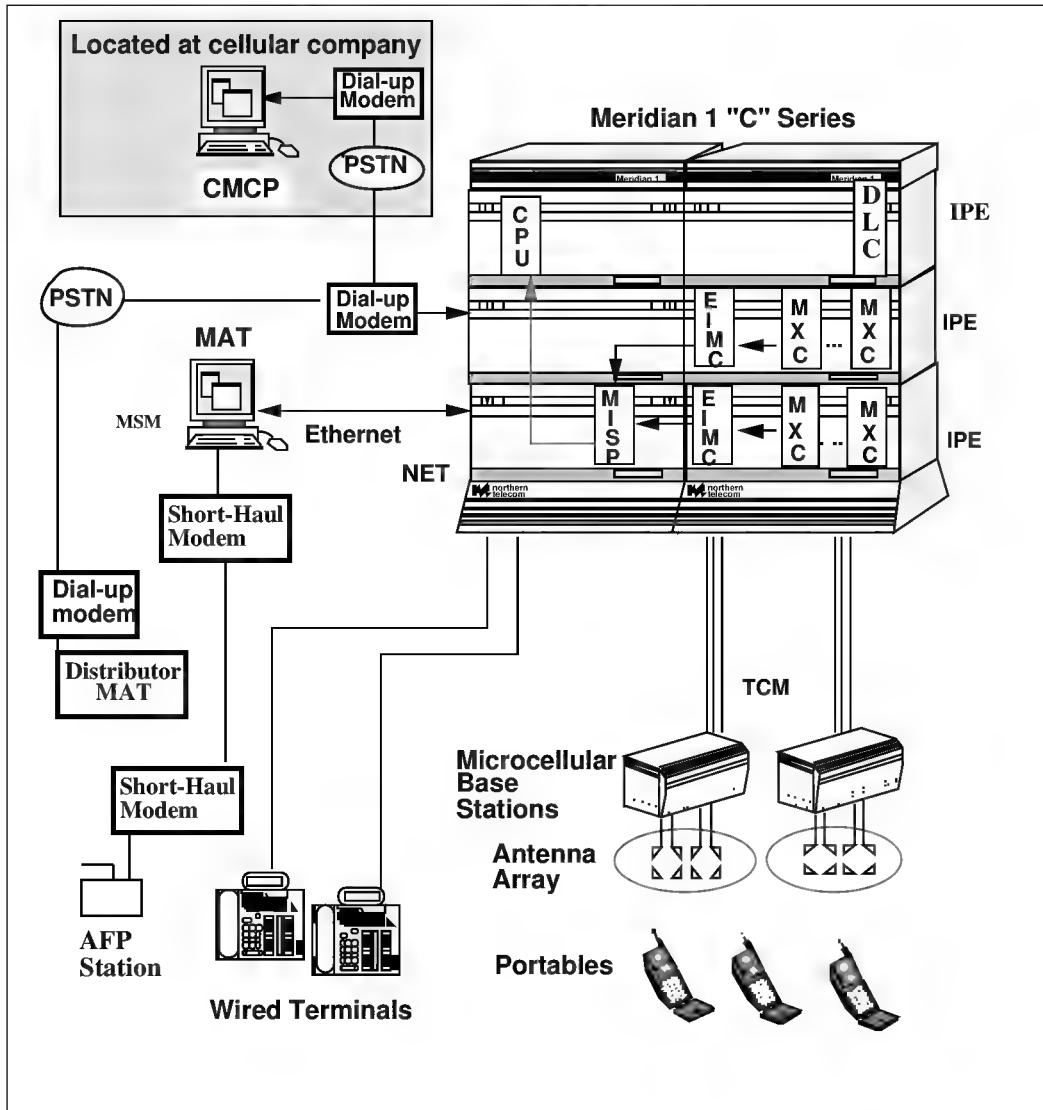
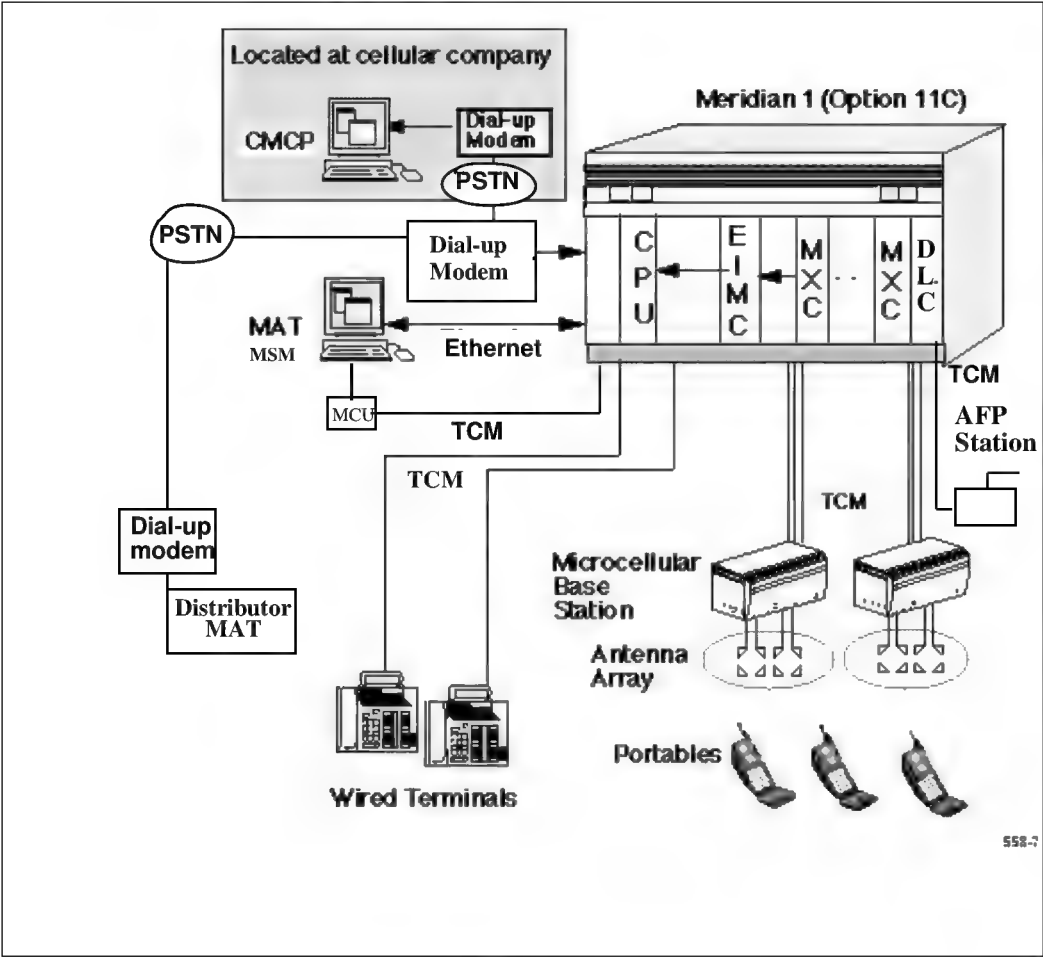


Figure 2
Microcellular system with serial connection to AFP Station



The Microcellular configuration is different for the smaller Option 11C systems, as Figure 3 shows.

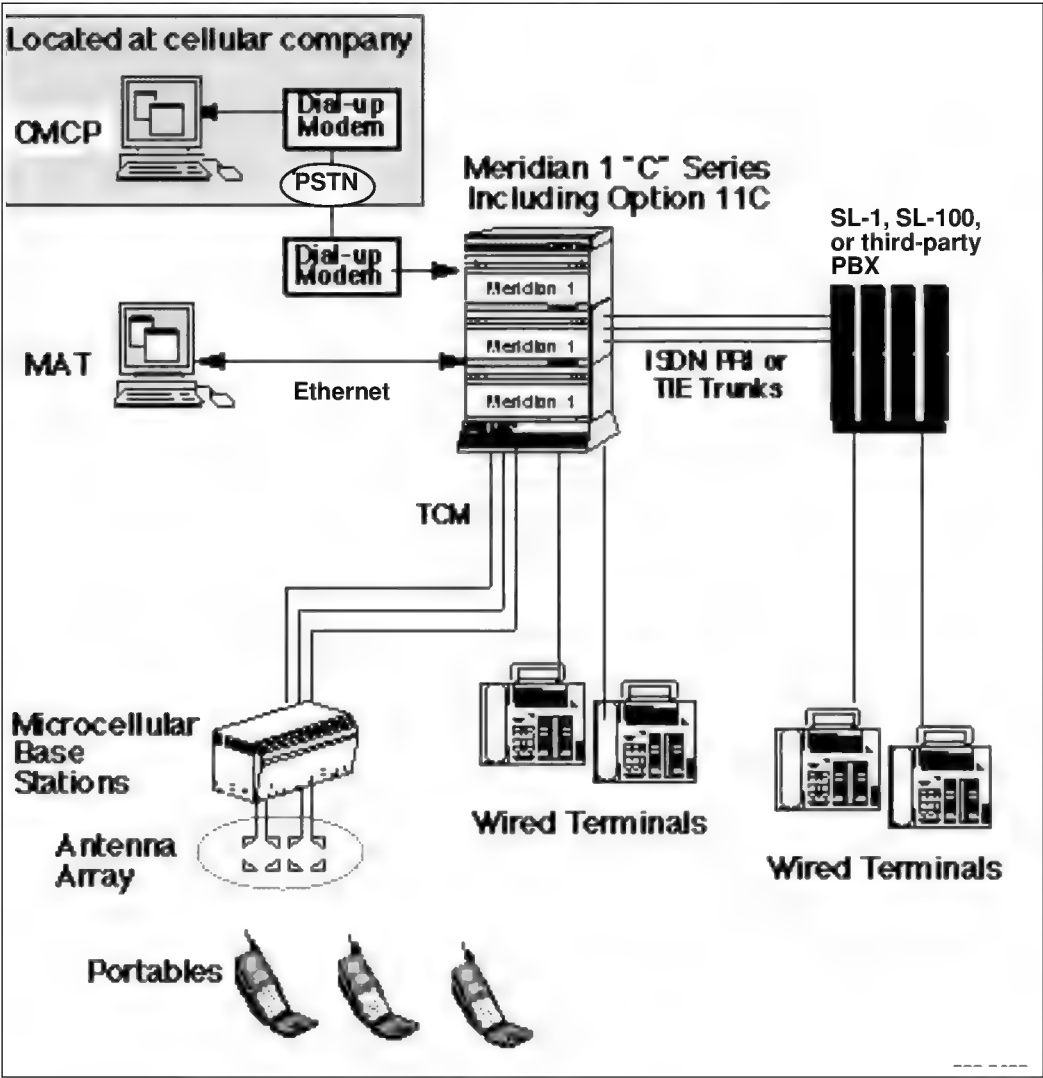
Figure 3
 Microcellular system model (Option 11C)



You can place Microcellular components in a Meridian 1 system and then connect them to an existing Meridian 1 SL-1 or SL-100 PBX or to a third-party PBX. This solution offers mobility services without upgrading or changing the existing PBX. The interconnection can be through private networking—for example, through a standard Integrated Services Digital Network (ISDN) PRA or Digital Trunk Interface. Figure 4 illustrates such connectivity.

For more information on the Microcellular system, see *Nortel COMPANION Microcellular Overview* (553-3611-100).

Figure 4
Example of Meridian SL-1, SL-100, or third-party PBX connectivity



Microcellular system components

A Microcellular system has the following hardware and software components:

- Meridian 1 Core software
- Multipurpose ISDN Signaling Processor (MISP)
- Embedded Intelligent Mobility Controller (EIMC)
- Microcellular Transcoder Card (MXC)
- Antenna array and hybrids (combiner/splitters)
- Microcellular Base Station (MBS), including TRU-IIIs
- Automatic Frequency Planning (AFP) Station and either of the following:
 - Meridian Communications Unit (MCU)
 - A pair of short-haul modems for each AFP Station
- Microcellular portables
- Meridian Administration Tool (MAT)

A Release 23 Microcellular system requires Mobility System Management (MSM) with the AFP feature on a local (on-site) MAT (running MAT 5.7+ software). The distributor might still choose to manage the site through an additional, remote MSM MAT.

- CMCP (Cellco Mobility Control Point) application on a MAT

A Microcellular system also includes the following logical components:

- Subsystem
- Zone
- Cell
- AFP region
- Neighbor cell

Meridian 1 Core software

The Meridian 1 Core software provides access to call control, call control services, and Meridian 1 set features for portables. Meridian 1 Core software provides call processing and switching capabilities for portables, so that portables can originate as well as receive voice calls. It also provides switching for call handoffs.

Meridian 1 Core software also extends a subset of existing Meridian 1 features, such as Call Forward All Calls and Transfer, to portable users for greater call management and convenience. For a list of these features, see “Meridian 1 system and set features” on page 20.

The Object Request Broker (ORB), part of the core software, provides the means through which object-oriented applications, or objects within object-oriented applications, can communicate by sending messages to each other rather than by sending messages through an IPC (interprocess communications) mechanism.

Multipurpose ISDN Signaling Processor (MISP)

The MISP provides routing and message relays between a Meridian 1 CPU and an Embedded Intelligent Mobility Controller (EIMC). One MISP can serve up to eight EIMCs.

A Microcellular system in an Option 51C, 61C, 81, or 81C system must use an MISP dedicated to the Microcellular system. In Option 11C, the MISP is not required because the EIMC can access the CE/MUX bus directly.

In Options 51C, 61C, 81, and 81C, the MISP provides a high-speed and high-bandwidth signaling path between cards on the peripheral shelf and the Meridian 1 CPU. The MISP sits directly on the CPU BUS and has “shared” memory-based communications with the Meridian 1 CPU.

The EIMC communicates with the Meridian 1 CPU through the MISP. A timeslot connection is nailed up between the EIMC and the MISP. The MISP Base Code and the Mobility Routing Application (MOB) provide the communications pipe between the EIMC circuit pack and the Meridian 1 CPU.

The MISP also provides relay and routing functions for the EIMC-to-EIMC communications needed for multi-EIMC systems or for Multi-Site Networking in Options 51C, 61C, 81, and 81C.

Embedded Intelligent Mobility Controller (EIMC)

The EIMC is the wireless controller for the Microcellular system. The EIMC handles all messages for call processing, location tracking, and intrazone and interzone handoffs. It also handles signaling among itself, the MISP pack, and the MXCs.

In an Option 51C, 61C, 81, or 81C system, the EIMC can be in any available IPE slot. In an Option 11C system, the EIMC must reside in the main cabinet.

Each EIMC on an Option 51C, 61C, 81, or 81C system controls up to 15 Microcellular Transcoder Cards (MXCs) on the same IPE shelf. A Microcellular system can support a maximum of 15 MXCs per IPE shelf. For a VSELP-only system, up to 12 MXCs per superloop may be configured. Each Option 51C, 61C, 81, or 81C system can include one or more EIMCs (one EIMC per IPE shelf).

To eliminate local switching conflicts, each Option 11C system is limited to one EIMC (in an IPE slot in the main cabinet), and each Option 51C, 61C, 81, and 81C system can include one or more EIMCs (a maximum of one EIMC per IPE shelf). Each EIMC provides the Microcellular functions for one zone.

EIMC software provides the following functionality for control, access, and management of the IS-136 and IS-54B Common Air Interface (CAI) radio protocols:

- IS-136 or IS-54B Protocol Stack (part of layer 3 protocol processing)
- Frequency Management
- Resource Management
- Portable Locating
- Server OA&M

The EIMC communicates with TRU-IIs via the nailed-up TCM connection from the MXC that serves the TRU-IIs. The EIMC manages TRU-II frequencies and timeslot assignments on those frequencies. It also determines when a handoff is necessary, by processing RSSI (Received Signal Strength Indicator) measurements from the TRU-IIs using Mobility-Assisted Hand-Off (MAHO) messages from the portables. The EIMC requests system resources as needed from its Abstract Switching Interface.

Microcellular Transcoder Card (MXC)

The MXC provides transcoding of voice within the Microcellular system. In an Option 51C, 61C, 81, or 81C system, an MXC must be configured on the same IPE shelf with the EIMC that controls the zone that the MXC serves and with the other line cards. In an Option 11C system, an MXC can reside in the main cabinet with the EIMC or in an expansion cabinet.

For ACELP/VSELP with a digital control channel, the MXC provides four TCM loop interfaces to the Microcellular Base Stations (MBSs). For VSELP, the MXC provides eight TCM loop interfaces to the MBSs. Each MBS uses up to four TCM interfaces (one per TRU-II). Each TCM interface is two wires (single twisted pair). Across this interface, the MXC does not provide loop powering—local power is required.

The MXC provides both TDMA-3 ACELP service and TDMA-3 VSELP service. ACELP implements the IS-641 protocol to provide toll-line voice quality.

An MXC can support one control-channel radio and up to seven traffic-channel radios for VSELP service or one control-channel radio and up to three traffic-channel radios for combined ACELP/VSELP service. Mobility System Management enables users to configure the MXC either as an ACELP card, which can default to VSELP (ACELP/VSELP), or as a VSELP only card.

The number of simultaneous calls depends on whether each call uses TDMA-3 voice or AMPS data and on the MXC configuration. The ACELP configuration, with VSELP default, handles up to nine simultaneous calls per MXC. In this case, each MXC can support a up to three traffic-channel TRU-IIs and one control-channel TRU-II. The VSELP-only configuration supports up to 21 simultaneous calls and eight TRU-IIs.

For TDMA-3 voice calls, the MXC provides multiplexing/demultiplexing, vocoder, and loss/level functions. Each call (of any protocol type) uses one DS-30X timeslot to the IPE Backplane. This is nonblocking for TDMA-3, for which a maximum of nine timeslots are required. The MXC uses one DS-30X timeslot for B-Channel HDLC signaling to the EIMC.

Microcellular Base Station (MBS) with radios

The MBS supports up to four radios. Each radio, a Transmit Receive Unit-II (TRU-II) for microcells, can operate independently as a control-channel radio or a traffic-channel radio (TDMA-3 voice, AMPS data). An internal 4 x 4 antenna matrix gives all four TRU-IIs simultaneous access to all four MBS antenna ports at the rear of the MBS.

Up to four MBSs can be co-located to provide support for up to 15 TRU-IIs on a common distributed antenna system.

The TRU-II software module does much of the protocol processing, equivalent to ISO layers 1, 2, and part of 3. The TRU-II communicates with the EIMC via the nailed-up TCM connection from the MXC.

The MBS requires local AC power (110/240VAC).

Microcellular antenna array

Antennas provide air access to Microcellular portables. Four rear-mounted antenna ports connect the MBS to the antenna array.

External to the MBS, the four ports can connect to an array of up to 16 antennas through two Dual 8-Port hybrids (combiner/splitters) or up to 8 antennas through a Quad 4-Port hybrid. Up to four MBSs can share the antenna array (allowing more TRU-IIs per cell) through the same Dual 8-Port hybrids or up to two MBSs can share the antenna array through a Quad 4-Port hybrid. Neither hybrid is necessary for a cell with only one MBS and up to four antennas.

The antenna array consists of directional and omnidirectional antennas connected via coaxial cable.

Automatic Frequency Planning Station (AFPS)

The AFP Station is a scanner-receiver that helps a cellular operator maintain the frequency plan of the microcell to prevent interference with the macrocellular system and to maintain signal quality for the Microcellular system. A Microcellular system requires at least 1 AFP Station.

An AFP Station can perform the following functions:

- Measure the forward and reverse Received Signal Strength Indicator (RSSI) on a specified channel or channels.
- Tune to each macrocell control channel and extract the SAT (Analog Supervisory Audio Tone), DVCC/DCC (Digital Verification Color Code/Digital Color Code), and SID (system identifier) values.
- Return the Bit Error Rate (BER) on a specified Microcellular control channel.

Each AFPS is connected to a DLC port on the Meridian 1 system through a TCM connection and emulates a phone set. Instead of TCM cabling, short-haul modems and telephone cable can provide a serial connection between an AFP Station and the local MSM MAT. The maximum length of TCM cable from an AFP Station to the Meridian 1 system is 3,000 ft. With a serial connection through short-haul modems, an AFP Station can be more than 3,000 ft from the Meridian 1 system.

The AFP Station is controlled by the MSM software running on a local MAT, which dials up an AFPS through a Meridian Communications Unit (MCU) or through the short-haul modems and queries the AFPS for data such as the RSSI and BER on specified channels. Part of Mobility System Management (MSM), the AFP software must run 24 hours a day on a local MAT that has access to the Meridian 1 system through an Ethernet interface.

Each AFP Station uses a local, plug-top power supply or, in some cases, a remote power supply. A Remote Power Interconnect (RPI) unit, either RPI8 or RPI16, can supply remote power for AFP Stations through a TCM connection.

Microcellular portables

A portable telephone in a Microcellular system is a wireless handset that conforms to the IS-136 (dual-mode ACELP or VSELP) or IS-54B CAI radio protocol. IS-136 has a digital or analog control channel. IS-54B is a subset of IS-136 and has only an analog control channel. Each portable device communicates with the Microcellular system via the air interface.

All industry standard portables that conform to the IS-136 or IS-54B standard will work with the Nortel COMPANION Microcellular system. Nortel has tested the Nokia 2160 portable for the IS-136 implementation or the Nokia 2120 portable for the IS-54B implementation.

The Nokia 2160 weighs 8.3 ounces with a slim NiMH battery. With this battery, the talk time is 70 minutes for a digital call or 45 minutes for an analog call, and the standby time is 14 hours. A larger NiMH battery extends the talk time to 210 minutes for a digital call or 120 minutes for an analog call and the standby time to 40 hours. This portable has a soft key interface.

Logical Microcellular components

During Microcellular system installation, you configure the following logical components for the Microcellular system:

- Zone
- Cell
- AFP Region
- Neighbor cell

Zone

A zone represents a geographic coverage area made up of smaller coverage areas (cells). A single EIMC serves each zone.

Cell

The cell (or partition) represents a geographic coverage area that the Microcellular system serves. A specific control channel and one or more voice channels serve each cell. Other cells in the same Microcellular system can use the same control channel and voice channels simultaneously, provided the cells are not adjacent. To prevent locating control channels and

voice channels too close together, cells using the same channels are a minimum of five cells apart and typically seven cells apart.

Each cell can support up to 15 TRU-IIs. For practical purposes, this limits a cell to four MBS components (because each MBS can support up to four TRU-IIs).

The forward channel, or downlink, in a cell is for MBS to portable communication.

The reverse channel, or uplink, in a cell is for portable to MBS communication.

A cell supports either the IS-136 radio protocol or the IS-54B radio protocol at a given time. All portable telephones that operate in the same cell must conform to the same radio protocol.

Neighbor cell

A neighbor cell is a logical component that represents an adjacent cell to which the Microcellular system can hand off a call.

External neighbor cell

An external cell can be one of the two neighbor cells for a Microcellular cell. An external neighbor cell is any macrocell that is adjacent to or overlaps a microcell. No handoffs are supported between an external neighbor cell and the microcell. A microcell can have more than one external neighbor cell.

Meridian Administration Tool (MAT)

The Meridian Administration Tool provides a platform for the Mobility System Management application and for Microcellular operations, administration, and maintenance (OA&M). A Release 23 Microcellular system requires MAT 5.7+ software.

At a Microcellular site, a local MAT connects to the Microcellular Meridian 1 system through Ethernet. A remote distributor MAT can also connect to the Meridian 1 system via dial-up modems (PPP) through a Public Switching Telephone Network (PSTN).

Nortel recommends an IBM PC™ or compatible for a local or remote MAT, with the following minimum configuration:

- Pentium 75 MHz CPU
- SVGA color monitor and interface card (800 x 600 resolution for graphics)
- Minimum of 500 MB of free space on hard drive (includes Windows 95™ requirements)
- 32 MB of RAM (upgradable)
- 3.5" floppy drive
- Two-button mouse
- 2 serial ports (at least one available if external modem is configured)
- Parallel port
- MS Windows 95 with TCP/IP
- Local connection to the Meridian 1 via Ethernet (required to run AFP software)
- Remote or local connection to the Meridian 1 via serial PPP Hayes compatible modem—internal or external (U.S. Robotics 28.8 preferred)
- Printer (optional)
- CD-ROM drive (optional, but recommended for the local MAT)

Cellco Mobility Control Point (CMCP)

The CMCP, an application that runs on the MAT 5 platform, enables a cellular company to control the use of voice channels and control channels by Microcellular systems within its licensed region. The CMCP application enables the cellular company to perform the radio frequency (RF) management of microcells.

Located at the cellular company site, the CMCP connects with the Meridian 1 system via a modem (PPP) connection through the Public Switching Telephone Network (PSTN).

For the CMCP connection, an Option 51C, 61C, 81, or 81C Meridian 1 system requires a serial port located on the network shelf of the system. This

serial port provides 24-hour access to the CMCP. The serial ports on the core CPU are not acceptable for CMCP access.

Cellular service providers control private systems to minimize interference with their macrocellular services. The CMCP provides this control for the Microcellular system and performs the following tasks:

- Communicates with the Meridian 1 via the Point-to-Point Protocol (PPP) over a dedicated modem.
- Completes the configuration of Microcellular components
- Monitors and manages the radio frequency (RF) channels within a Microcellular system
- Initiates and monitors a “keep-alive” heartbeat between the CMCP and the Microcellular system
- Controls Automatic Frequency Planning (AFP) for the Microcellular system
- Specifies the maximum number of portables allowed and, optionally, secures the portable ESNs.

In addition to component configuration and channel allocation, the CMCP monitors Microcellular operation. If three consecutive heartbeat failures occur, the CMCP automatically shuts down and locks the Microcellular system.

Downloadable software

A number of software components are required to implement wireless access to the Meridian 1. All of these modules are preprogrammed and executed on the system's distributed processing platforms, including the MXCs, the EIMC, the TRU-IIs, and (except in Option 11C systems) the MISP and the XPEC. The Meridian 1 Core software downloads software to these distributed processors from the system disk when there is a software version mismatch between the system disk and the card or TRU-II or when the processor software on the card or TRU-II is invalid.

Once downloaded to the target platform, the software modules are stored in the platform's nonvolatile storage (EEPROM). This eliminates the need to download the software module until one of the following conditions occurs: system software upgrade or scheduled maintenance routines on the peripheral platform.

Configuration data

The following administrative data is required for the Microcellular system to operate:

- Configuration data

Microcellular components need data that describes the hardware configuration, at several levels. The MISP's Mobility Routing Application needs information about the EIMCs served by the MISP. The EIMC needs to know the configuration of MXC cards and TRU-IIs on its shelf. Finally, the MXC needs information about the TRU-IIs connected to it and whether the MXC provides both ACELP and VSELP service or only VSELP service.

- Protocol-specific data

The EIMC needs information concerning the IS-136 or IS-54B protocol, such as protocol timers, available frequency lists, and handoff thresholds.

- Microcellular user data

The EIMC needs Microcellular user parameters downloaded to it. Data for user verification resides on the EIMC in access tables. These tables contain both user administrative data and location information.

Microcellular system capacity

Options 11C, 51C, 61C, 81, and 81C:

- Minimum of two TRU-IIs (radios) per MBS and cell (one TRU-II must be a control channel)
- Maximum of four TRU-IIs per MBS
- Maximum of four MBSs per cell
- One control-channel radio plus a maximum of three traffic-channel radios (TDMA-3 voice and AMPS data) per MXC for ACELP/VSELP
- One control-channel radio plus a maximum of seven traffic-channel radios (TDMA-3 voice and AMPS data) per MXC for VSELP only
- Minimum of one and maximum of 12 AFPS per Microcellular system

Options 51C, 61C, 81, and 81C:

- Maximum of 15 MXCs per IPE shelf for each EIMC. For a VSELP-only system, up to 12 MXCs per superloop may be configured.

Option 11C:

- Maximum of one EIMC
- Maximum of 15 Microcellular Transcoder Cards (MXCs) served by one EIMC

Although you can determine the maximum number of Microcellular users that a given system can support only after a review of the available memory, an Option 81 or 81C system can support up to 3,000 portable users, an Option 51C or 61C system can support up to 500 users, and an Option 11C system can support up to 200 users.

With 1% RF subsystem blocking for a 2-1/2 minute call, a single TDMA-3 voice channel can support up to 10 users in a single cell, two voice channels can support up to 46 users, and three voice channels can support up to 91 users. With 2% RF subsystem blocking, one channel can support up to 14 users, two channels can support up to 54 users, and three channels can support up to 104 users.

Multi-Site Networking

Multi-Site Networking is an optional feature of the Microcellular product that enables portable users who travel to networked locations to place and receive calls from their portables as if they were at their home system. It supports incoming call delivery to and outgoing call origination from a roaming portable at any Meridian 1 PBX that a portable user visits within a single private network.

When a portable roams to a visited system, the portable performs a location registration there. The visited system notifies the portable's home system, which updates its Home Location Register (HLR) with a "forwarding address" to which it can direct incoming calls for the portable.

A visited Meridian 1 PBX is on the same private network as the portable's home Meridian 1 system. Customer-defined ISDN links connect the Microcellular sites. Each Meridian 1 system in the Microcellular network has its own connection to the region's CMCP, which provides the cellular company with control over the Microcellular systems in its network. Each Meridian 1 system in the same Microcellular network uses the same dialing plan, either the Uniform Dialing Plan (UDP) or the Coordinated Dialing Plan (CDP), but not both.

For more information on Multi-Site Networking, see *Nortel COMPANION Microcellular Multi-Site Networking Description, operations, and administration* (553-3611-110).

Portable locating

The Microcellular system locates a portable to present it with an incoming call. Portable locating finds a user and establishes the appropriate data link so that the system can deliver the incoming call.

At any given time, the Microcellular system knows the zone in which to locate the portable so that the system pages necessary cells to find the portable when a call arrives. The system's HLR maintains information about the EIMC where the portable is located. In turn, the EIMC maintains information in the HLR about the zone where the portable is located.

The Microcellular system can issue a location update request, asking that each portable within its domain perform a location registration to inform the system of its current location. A location update is useful after a system restart (SYSLOAD or INIT) to ensure that location information in the system's HLR and VLRs are updated and accurate.

Portable features

With the Microcellular system, the Meridian 1 provides the following features for portables:

- Meridian 1 set features
- Meridian 1 system features
- Registration/Deregistration
- Basic Call Setup
- Teardown of Incoming and Outgoing Calls
- Handoffs of established calls

Meridian 1 system and set features

The following Meridian 1 system and set features are available to portables through the Microcellular system. For more information on these system and set features, see the *Nortel COMPANION Microcellular Operations, administration, and maintenance guide* (553-3611-300).

- Access Restrictions
- Access to Paging
- Access to Recorded Telephone Dictation
- Attendant Features
 - Attendant End-to-End Signaling
 - Automatic Timed Reminders
 - Busy Lamp Field
 - Splitting
- Call Detail Recording (CDR) / CDR on Redirected Calls
- Call Forward All Calls
- Call Forward Busy
- Call Forward External
- Call Forward No Answer
- Calling Line Identification (CLID)
- Calling Party Name Display (CPND) (see **Note**)

- Call Park / Call Park Networkwide
- Call Redirection Service (see *Note*)
- Call Redirection by Time Of Day
- Call Transfer (see *Note*)
- Call Waiting
- Call Waiting Redirection
- Conference (3-party) (see *Note*)
- Direct Inward System Access (DISA)
- Directory Number Expansion
- Direct Private Network Access
- Electronic Switched Network (ESN)
 - End-to-End Signaling
 - ESN Uniform Dialing Plan
 - Network Alternate Route Selection (NARS)
 - Network Call Transfer (see *Note*)
 - Network Class of Service
 - Network Control Signaling
- Hunting (see *Note*)
- Intercept (see *Note*)
- ISDN Primary Rate Interface
 - Basic Call, North America ISDN PRA Connectivity
 - Call Redirection Service (see *Note*)
 - CLID
 - Network Call Party Name Display (see *Note*)

- Messaging Centers
 - IVMS/IMS
 - Meridian Mail
 - Message Waiting Center (see *Note*)
- Message Waiting Indication
- Multiple Appearance Directory Number (MADN) (see *Note*)
- Multi-Customer
- Music / Enhanced Music
 - Network Message Services
 - Meridian Mail
 - Message Centers (see *Note*)
 - Night Service / Trunk Answer from Any Station (TAFAS) (see *Note*)
 - Trunk Route Optimization Before Answer
- One Number Call Delivery (see *Note*)
- Pretranslation
- Recorded Announcement
- Recorded Announcement for Calls Diverted to External Trunks
- Secretarial Filtering
- Speed Call / System Speed Call (see *Note*)
- Timed Forced Disconnect
- Trunk Anti-Tromboning
- User Selectable Call Redirection (see *Note*)
- Wireless Privacy

Note: This feature operates differently in conjunction with a portable set than with wired sets. In some cases, certain limitations apply to use with a portable. For a detailed explanation of the operation of all Microcellular features, see the *Nortel COMPANION Microcellular Operations, administration, and maintenance guide* (553-3611-300). For information about feature operation and support for the Multi-Site Networking option, see the *Nortel COMPANION Microcellular Multi-Site Networking Description, operations, and administration* (553-3611-110).

Registration/deregistration

Registration refers to the process in which a portable informs the system of its presence in a cell and requests permission to use the system's services. A portable must register before it can receive services from the system. Before a portable can register, you must configure it through the MAT.

The first time a portable powers up, it identifies itself to the Meridian 1 Core software, through the TRU-II and the EIMC, as being active.

When the portable roams to a different cell served by the same EIMC, registration is performed within the EIMC. When the portable roams to a cell served by a different EIMC, the Meridian 1 Core coordinates registration activity between the two EIMCs.

Incoming calls

To receive incoming calls, a portable must be registered and in the Unlocked state. When the Microcellular system presents an incoming call to a portable, the portable provides ringing. The Meridian 1 sends CLID information to the portable simultaneously with the delivery of the incoming call. The originating party receives ringback from the Meridian 1 while a TRU-II locates and pages the portable.

Outgoing calls

Once registration is completed and services are granted, a portable can initiate outgoing calls while in the Unlocked state. The Microcellular system supports Enbloc dialing (predialing). Upon completion of dialing an outgoing call, the portable receives a ringback tone.

The Meridian 1 Class of Service for the system and users as well as the portable configuration determines what outgoing calls are allowed or denied.

Handoffs

Handoffs enable portables to maintain an active call while moving around within the area covered by the Microcellular system. In Option 51C, 61C, 81, and 81C systems, intrazone handoff occurs between cells within the same zone. Interzone handoff occurs between different zones within a Microcellular system.

Figure 5 illustrates an intrazone handoff in Option 51C, 61C, 81, and 81C systems. The EIMC handles an intrazone handoff, while the XPEC manages the switching. This handoff is transparent to the Meridian 1 Core software.

An Option 11C system supports only intrazone handoff because it has only one EIMC. The EIMC handles the handoff. Meridian 1 Core software manages the switching.

Figure 6 illustrates interzone handoff in Option 51C, 61C, 81, and 81C systems. The EIMCs handle the interzone handoff, working in conjunction with each other. The EIMCs exchange ORB invocations via TCP/IP running over nailed-up timeslots. Meridian 1 Core software manages the switching.

Figure 5
Intrazone handoff on Meridian 1 (Options 51C, 61C, 81, and 81C)

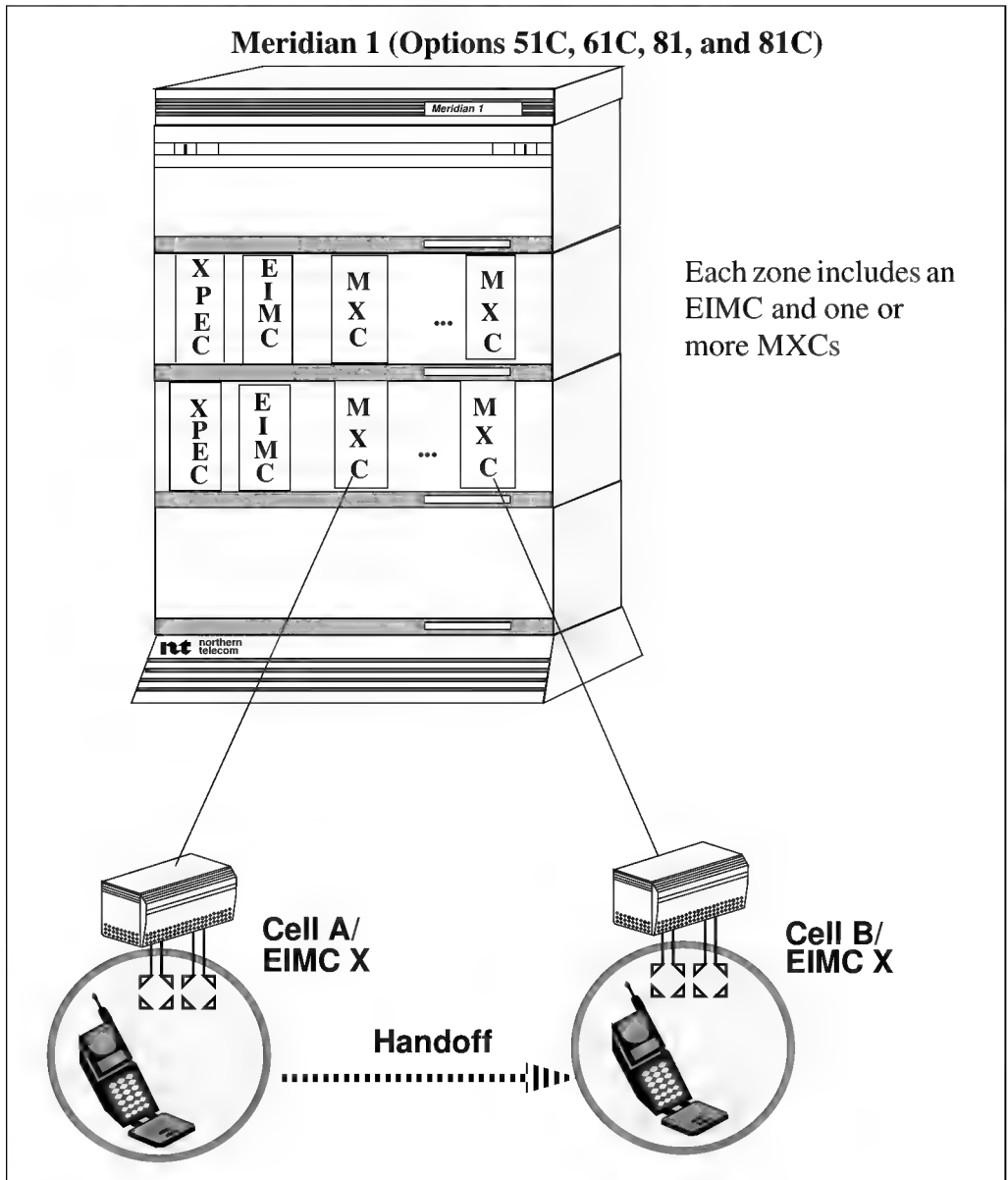
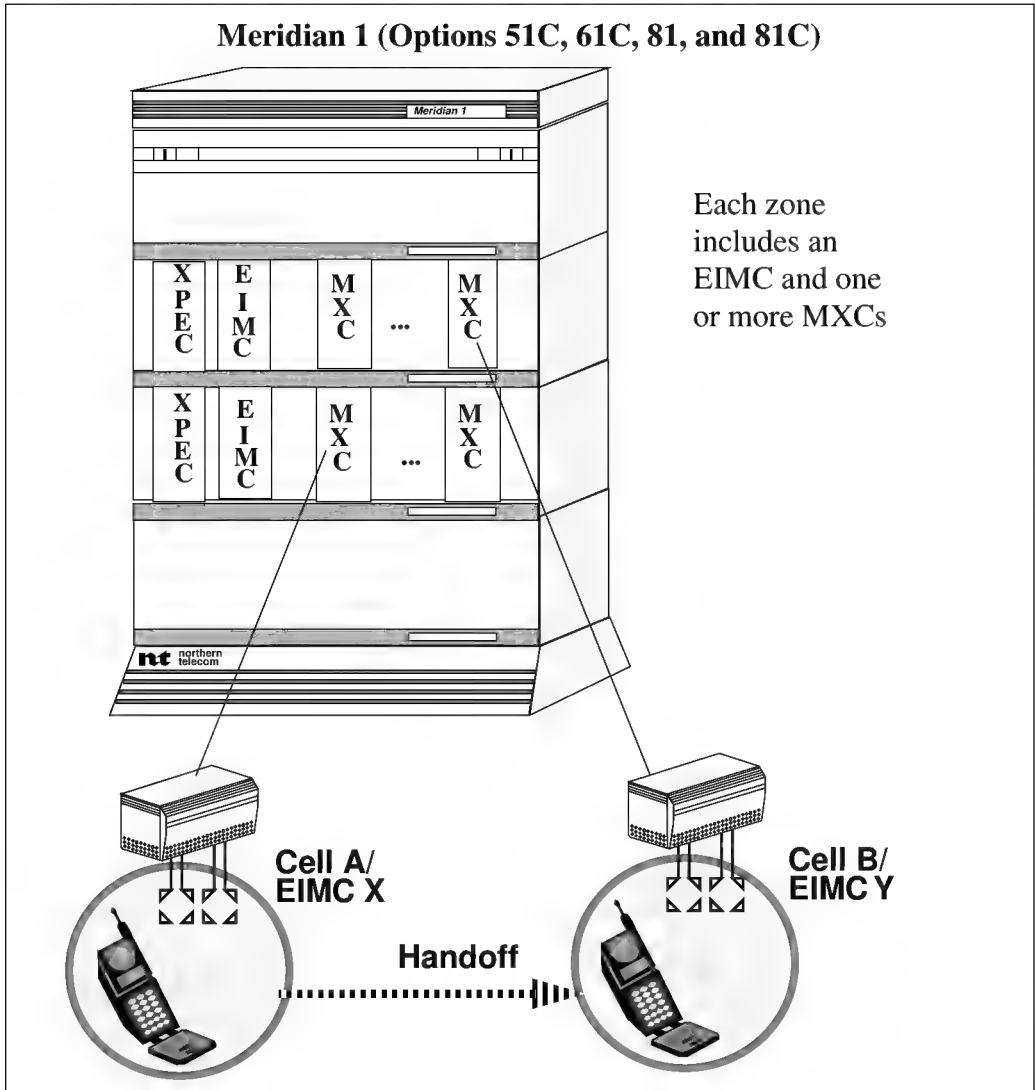


Figure 6
Interzone handoff on Meridian 1 (Options 51C, 61C, 81, and 81C)



Microcellular dial access to set features

For features that the user can activate or deactivate, the Microcellular system supports only the dial access method. Where possible, the feature-code strings that portable users enter to invoke features should be consistent or not in conflict with the codes that are currently in use in the cellular environment. This enables portable users to use the features consistently from macrocellular to Microcellular system, and vice versa.

The Microcellular system provides the following special feature codes:

- Mobility Special Prefix (MSPRE)
- Mobility Feature Code (MFCO)

The Mobility Special Prefix codes are system-defined numbers of up to four digits that are used in place of existing SPRE codes to activate dial access features from portables. A unique MSPRE is defined for each customer, using digits (0-9) and the asterisk (*) to activate features. Each MSPRE must be a unique number up to four digits long. It cannot conflict with any Directory Number (DN) already in the dialing plan, with the exception that MSPRE and SPRE can share the same value. The default value of the Mobility Special Prefix is asterisk (*). The Mobility SPRE operates independently from the existing SPRE dialing and Flexible Feature Code (FFC) features.

A Mobility Feature Code is a dialing sequence that the portable user enters to invoke a specific feature. A one-to-one mapping exists between a dial access feature and each MFCO. You define Mobility Feature Codes for each system, using digits (0-9). A selected MFCO can have the same value as another number in the dialing plan but should not conflict with cellular feature codes. You can define an MFCO to be the same as the fixed feature access code that users currently dial after SPRE to invoke a given feature.

Together, MSPRE+MFCO form a feature-code string for feature invocation and cancellation.

Note: Feature operations of Transfer, Three Party Conference, and Call Waiting do not require MSPRE or MFCO.

Meridian 1 SL-1 or third-party PBX connectivity

You can place Microcellular components in a Meridian 1 system and then connect them to an existing Meridian 1 SL-1, SL-100, or Norstar switch or to a third-party PBX. This solution offers mobility services without upgrading or changing the existing PBX. The interconnection can be through private networking—for example, through a standard Integrated Services Digital Network (ISDN) PRA or Digital Trunk Interface, such as T1 or PRI.

Incoming calls to a portable can be achieved by giving Call Forward No Answer treatment to calls terminated on a wireline set. Outgoing calls from a portable across an ISDN PRA or DTI trunk require dialing Trunk Access Codes or codes defined for the Coordinated Dialing Plan. Twinning is not provided in this configuration.

With such a system arrangement, in addition to features available on the Microcellular Meridian 1, portables can have access to networking features provided by the host PBX. If the trunks to and from the Microcellular Meridian 1 are busy, portables receive existing intercept treatment. For a simple call involving a set connecting to the host PBX and another set to the Microcellular Meridian 1, CLID display might be possible, depending on the trunk type, as with any networking calls.

Microcellular system installation

Before installation of a Microcellular system, be sure that the Meridian 1 system has all necessary prerequisites, including X11 Release 23 and MAT 5.7+ software. For a complete list of Microcellular and system prerequisites, see “Preparing for installation” on page 37.

The procedure for installing a Microcellular system follows. The rest of this Installation guide describes the procedure in detail.

- 1 Software installation on the Meridian 1 system, which includes Microcellular packages and, optionally, the Multi-Site Networking package (“Installing, upgrading, and downloading software” on page 41)

The distributor installs or upgrades Meridian 1 software.

- 2 Setup of a Meridian Administration Tool (MAT) connected to the Meridian 1 system, including installation of Mobility System Management (MSM) software and configuration and verification of the communications link to the Meridian 1 system (“Setting up the MAT” on page 49)
 - a The distributor installs a MAT, if necessary, ensuring that the security device is installed on the parallel port. (*Meridian Administration Tools MAT 5 Common Services User guide (P0867952)*)
 - b The distributor installs MAT software on the MAT, following instructions that come with the software (Common Services, Station Administration, and, optionally, other MAT applications).
 - c The distributor connects the hardware between the MAT and the Meridian 1 system.
 - d The distributor installs the Mobility System Management (MSM) application on a MAT, following instructions that come with the software.
 - e The distributor adds the Meridian 1 system to the MAT software and configures MAT access to the system.
 - f The distributor selects and enables the Microcellular application, the Microcellular AFP application, and the Station Administration application through the Applications page on the MAT Navigator Site property sheet.
 - g The distributor verifies the communications link between the Meridian 1 system and the MSM MAT.
 - h Synchronize the PC with the Meridian 1 system by invoking Update System Data via the System window.

For MAT details, see the *Meridian Administration Tools MAT 5 Common Services User guide (P0867952)*.

- 3** Microcellular CMCP installation (Appendix D: “Cellular operator guide” on page 293)
 - a** The cellular operator installs a physical modem (PPP) connection for the CMCP to connect to the Meridian 1 system.
 - b** The distributor installs and configures a modem (PPP) connection, if needed, to a Meridian 1 port for the CMCP to use. (“Configuring modems for CMCP or MAT access” on page 61)
 - c** The distributor provides dial-in access information to the cellular operator (modem DN, user ID, and password).
 - d** The cellular operator installs a MAT, ensuring that the security device is installed on the parallel port.
 - e** The cellular operator installs the Microcellular CMCP application on the MAT.
 - f** The cellular operator adds the Meridian 1 Microcellular system to the CMCP software through the MAT Navigator window.
 - g** The cellular operator enables and selects Communications Channel through the MAT Application property sheet.
 - h** The cellular operator verifies the dial-in link to the Meridian 1 system from the CMCP by connecting to the Meridian 1 system. (“Connecting to a Microcellular system” on page 337)
 - i** The cellular operator sets up a device to view Microcellular alarms and operational measurements. (“Monitor alarms and operational measurements” on page 386)

- 4** Hardware installation at the Microcellular site
 - a** The distributor installs Microcellular Base Stations, including TRU-II radios. (“Installing Microcellular Base Stations” on page 105)
 - b** The distributor installs the antenna structure: coaxial cables, hybrids, and antennas. (“Installing the antenna structure” on page 65)
 - c** The distributor installs the AFP Station or Stations. (“Installing Automatic Frequency Planning (AFP) Stations” on page 133)
 - d** The distributor tests the RF coverage of the antenna structure. The cellular operator might want to be present for testing. (“Testing the radio frequency (RF) coverage” on page 147)
 - e** The distributor installs Microcellular cards in the Meridian 1 system. (“Installing Microcellular cards” on page 175)
 - f** Optionally, the distributor can install and configure a buffer box to forward alarms to the cellular operator. (“Buffer box implementation” on page 386)
- 5** Microcellular component configuration from the MSM MAT and the CMCP (“Configuring Microcellular components” on page 179)
 - a** The distributor connects to the Microcellular Meridian 1 system through the MSM MAT. (“Connecting MSM to a Meridian 1 system” on page 191)
 - b** The distributor configures the Meridian 1 MISP card. (“Configuring a MISP card” on page 195)
 - c** The distributor and cellular operator configure the Microcellular subsystem. (“Configuring a Microcellular subsystem” on page 197 and “Configure maximum number of portables” on page 339)
 - d** The distributor configures the Meridian 1 EIMC card or cards. (“Configuring EIMCs” on page 203)
 - e** The distributor configures the Meridian 1 MXC card or cards. (“Configuring MXCs” on page 209)

- f The distributor partially configures the Microcellular zones, cells, MBSs, radios, and AFP region and configures the AFP Stations:
 - 1) The distributor adds and configures at least one zone. (“Configuring zones” on page 215)
 - 2) The distributor adds and configures at least one cell. (“Configuring cells” on page 221)
 - 3) The distributor adds and configures at least one MBS for each cell. (“Configuring Microcellular Base Stations” on page 227)
 - 4) The distributor adds, configures, tests, and downloads software to at least two TRU-Is for each cell. (“Configuring radios” on page 231)
 - 5) The distributor configures the AFP region and then adds and configures at least one AFP Station. (“Configuring the AFP region and Stations” on page 239)
- g The cellular operator manually configures neighbor cells. Traffic frequency and external cells are configured either automatically by AFP or manually by the cellular operator. The cellular operator completes the zone, cell, and AFP region configurations. The distributor unlocks Microcellular objects. (“Configuring and maintaining Microcellular systems” on page 334 and “Initializing a Microcellular system” on page 247)

Option 1: Seed traffic frequencies and manually program external cells

- 1) The cellular operator adds external cells.
- 2) The cellular operator configures neighbor cells.
- 3) The cellular operator adds external cells for neighbor cells.
- 4) The cellular operator completes zone and cell configurations, including entering both control and voice frequencies and enabling AFP for cells through the CMCP.
- 5) The cellular operator configures the AFP region parameters.

- 6) The distributor unlocks the AFP region object.
- 7) The distributor unlocks each EIMC, MXC, and zone and the cell or cells within each zone. The distributor resets the radios in each cell, by removing and reinstalling the TRU-IIs, and then unlocks the radios.

Option 2: Have AFP pick traffic frequencies and manually program external cells

- 1) The cellular operator adds external cells.
- 2) The cellular operator configures neighbor cells.
- 3) The cellular operator adds external cells for neighbor cells.
- 4) The cellular operator completes zone and cell configurations, including enabling AFP for cells but not entering voice frequencies.
- 5) The cellular operator configures the AFP region parameters.
- 6) The distributor makes sure that all the Microcellular components except the subsystem are locked.
- 7) The distributor unlocks the AFP region and waits for *convergence*, a stage in which AFP has generated a set of stable backup frequencies. Convergence can take from two hours to three days, depending on the Microcellular system configuration and the AFP parameters set through the CMCP.
- 8) After AFP reaches convergence, the distributor unlocks each EIMC, MXC, and zone and the cell or cells within each zone. The distributor resets the radios in each cell, by removing and reinstalling the TRU-IIs, and then unlocks the radios.

Option 3: Seed traffic frequencies and have AFP configure external cells

- 1) The cellular operator completes zone and cell configurations, including entering voice and control frequencies and enabling AFP for cells through the CMCP.
- 2) The cellular operator configures the AFP region parameters.
- 3) The distributor unlocks the AFP region object.

- 4) The cellular operator waits for external cells to be automatically configured.
- 5) The cellular operator configures neighbor cells.
- 6) The distributor unlocks each EIMC, MXC, and zone and the cell or cells within each zone. The distributor resets the radios in each cell, by removing and reinstalling the TRU-IIs, and then unlocks the radios.

Option 4: AFP selects traffic channels and configures external cells

- 1) The cellular operator completes zone and cell configurations, including enabling AFP for cells through the CMCP but not entering voice channels.
- 2) The cellular operator configures the AFP region parameters.
- 3) The distributor makes sure that all the Microcellular components except the subsystem are locked.
- 4) The distributor unlocks the AFP region object.
- 5) The cellular operator waits for external cells to be automatically configured.
- 6) The cellular operator configures neighbor cells.
- 7) After AFP reaches convergence, the distributor unlocks each EIMC, MXC, and zone and the cell or cells within each zone. The distributor resets the radios in each cell, by removing and reinstalling the TRU-IIs, and then unlocks the radios.

- 6** Portable configuration (which the cellular operator and distributor can do while waiting for convergence or automatic configuration of external cells) (“Configure maximum number of portables” on page 339 and “Configuring portable telephones” on page 251)
 - a** The cellular operator specifies the maximum number of portables.
 - b** The cellular operator selects the encrypted ESN option, if desired.
 - c** The cellular operator provides the portable Mobile Identification Numbers (MINs) and Electronic Serial Numbers (ESNs), possibly encrypted.
 - d** The cellular operator provides the directory number(s) for alarm and operational measurements (OM) notification.
 - e** The distributor configures the portables with the Mobile Identification Numbers (MINs) and Electronic Serial Numbers (ESNs) provided by the cellular operator.
- 7** Installation verification (initial installation)
 - a** The distributor and the cellular operator commission the Microcellular system (setting uplink and downlink power levels and making sure that antennas are pointing correctly).
 - b** The cellular operator and the distributor test call placement and reception.
 - c** The cellular operator and the distributor perform RF optimization (testing reselection and call handoff for multiple cells and adjusting pertinent parameters).
 - d** The cellular operator and the distributor troubleshoot any portable problems.
 - e** The cellular operator and the distributor test Microcellular interference outdoors.

Nortel recommends a laptop CMCP for adjusting RF parameters at the customer site during installation verification.

During Microcellular component configuration, the distributor might need to delete one or more Microcellular objects, correct an installation problem, and then add the object or objects again. For details, see “Deleting objects from MSM” on page 245.

For instructions on upgrading an existing Microcellular system from VSELP only service to ACELP/VSELP service, see “Upgrading from VSELP to ACELP” on page 271.

Preparing for installation

To install a Microcellular system, you need copies of all site planning documents, the Microcellular hardware components, and installation tools and supplies. The site planning documents should include a list of materials that you need to check to ensure that all equipment and supplies are available.

Preinstallation tasks

Before beginning the installation of a Microcellular system, verify that the following tasks are complete:

- Site planning and deployment, the process of determining the location and number of Microcellular Base Stations and antennas required at a customer site
- Ordering and procurement of all equipment that the site planning documents specify
- Installation of X11 Release 23 software on a Meridian 1 system, Option 11C, 51C, 61C, 81, or 81C (see “Installing Meridian 1 software packages” on page 42)
- For an Option 51C, 61C, 81, or 81C system, preparation of the IPE shelf to meet the following requirements:
 - Sufficient slots available for Meridian 1 Microcellular cards
 - For a Microcellular system that will use TCM connections to the AFP Station or Stations, a Digital Line Card (DLC) with one port available for the MCU and one port available for each AFP Station
- For an Option 51C, 61C, 81, or 81C system, preparation of the network shelf to ensure that a slot is available for an MISP card (in addition to any existing ISDN MISP card) and that an XNET card is already installed

- For an Option 11C system
 - Upgrading the CPU card for memory expansion to 16 Mbytes SIMM
 - Preparation of the main cabinet to ensure that an IPE slot is available for the EIMC card, that enough slots are available in the main cabinet or in expansion boxes for MXC cards, and that a Digital Line Card (DLC) has one port available for the MCU and one port available for each AFP Station
 - Addition of an EDC (Extra Data Card) in slot B, with 20 Mbytes or more of flash memory for storage and downloading of Microcellular loadware
- For installation of each component, procurement of the tools and supplies necessary for installation. (See “Preparing for MBS installation” on page 105, “Preparing for antenna installation” on page 70, “Assembling cables and connectors” on page 77, and “Installing Microcellular cards” on page 175.)
- Taking inventory to ensure that all equipment and components are available for installation
- Installation of a local Meridian Administration Tool (MAT) 5.7+ and, optionally, a remote distributor MAT (5.7+), each running Mobility System Management with the AFP feature
- Installation of the CMCP at the cellular service provider’s site
- Verification of the link to the Meridian 1 system from the MSM MAT and from the CMCP

Preinstallation checklist

Before beginning the installation, complete the following checklist:

- Has the cellular operator approved the final deployment plans and approved allocation of the required cellular channels?
- Are site floor plans with equipment locations available?
- Are the preinstallation tasks complete?
- Is the Meridian 1 accessible?

- Is all the test equipment necessary to complete the job on site? (See “Test equipment” on page 147.)
- Is all the Microcellular equipment on site? Is it inventoried?
- Is the customer-supplied equipment on site? Has it been installed?
- Who is responsible for installing the antenna system?
- Is the cellular operator ready to download the channels, radio parameters, and portable Mobile Identification Numbers (MINs) and Electronic Serial Numbers (ESNs)?
- Has the cellular operator provided portables, properly programmed?

Installation warnings and safety instructions

Please observe the following warnings and safety instructions during the installation and operation of the Microcellular system to reduce the risk of fire, electric shock, or injury:

- Follow the warnings and instructions marked on the equipment
- Do not use equipment in or near a wet environment.
- Never place equipment near or over a radiator or heat register.
- Never place equipment in an enclosure unless proper ventilation is provided.
- Do not allow anything to rest on power cords.
- Never push objects of any kind into card slots.
- Do not locate equipment where someone might walk on a power cord.
- Do not overload AC outlets and extension cords.
- Do not disassemble equipment. When any service or repair work is required, send the equipment to a qualified service person.

- Unplug equipment from the AC outlet and refer servicing to qualified personnel if any of the following occurs:
 - A power cord is damaged or frayed.
 - Equipment has been exposed to rain, or liquid had been spilled on any part of it. (If this happens, disconnect it, and then allow the equipment to dry out to see if it still operates. Do not open the equipment.)
 - An equipment housing has been damaged.
- Notify service personnel if performance deteriorates.
- Do not use any telephone to report a gas leak in the vicinity of the suspected leak.

Installing, upgrading, and downloading software

You can install or upgrade Meridian 1 software for a Microcellular system on a Release 23 or later Meridian 1 system and the Mobility System Management application on a Meridian Administration Tool (MAT) 5.7+, which connects to the Meridian 1 system.

If you are upgrading your Microcellular system and want to add ACELP service, see “Upgrading from VSELP to ACELP” on page 271.

The Meridian 1 Microcellular cards include software preprogrammed on Flash EPROM (FEPRM). Meridian 1 Core software downloads Microcellular software and parameters as needed to the Microcellular cards and to TRU-II radios in Microcellular Base Stations.

On the CMCP, which the cellular operator installs, the operator configures system parameters for the Microcellular system during system initialization or when the CMCP configuration changes. The CMCP downloads the parameter information to the Meridian 1 system. The initial CMCP download to the Meridian 1 system normally occurs after you configure the Microcellular components and before you unlock them.

For software installation, an Option 11C system must have an extra data card that remains in slot B on the CPU card during operation of the Microcellular system.

For parameter downloads, the Meridian 1 system must have a dial-up link with the CMCP, through a modem. For more information about the link to the CMCP, see “Configuring modems for CMCP or MAT access” on page 61.

This section lists the Meridian 1 software packages for a Microcellular system and gives an overview of downloading Microcellular software and parameters from a Meridian 1 system. For information about software installation on the MAT, see “Setting up the MAT” on page 49.

Installing Meridian 1 software packages

The Meridian 1 system on which you configure the Microcellular system must run Release 23 software with the following software packages equipped.

To run a Microcellular system on an Option 51C, 61C, 81, or 81C Meridian 1 Release 23 system, you need the following products:

- SW000I X11R23 Base Software
 - BRI (216)
 - Phantom TN (254)
- SW0500A Mobility Microcellular Software
 - MOSR (302)
 - MMO (303)
- Microcellular MAT Package
 - Alrm_Filter (243)
 - LAPW (164)
 - MULI (242)
 - MAT (296)

To run a Microcellular system on an Option 11C Meridian 1 Release 23 system, you need the following products:

- NTSF8020 Opt 11 R23 Software—General Business
 - BRI (216)
 - Phantom TN (254)

- SW0501A Mobility Microcellular Software
 - MOSR (302)
 - MMO (303)
- Microcellular MAT Package
 - Alrm_Filter (243)
 - LAPW (164)
 - MULI (242)
 - MAT (296)

The following packages, for Multi-Site Networking, are optional:

- MMSN (314)
- ISDN (145)
- PRA (146) (1.5 Mbytes)
- ISL (147)
- Ntwk_Srvc (148)
- NARS (58) or CDP (59)

Downloading software

All Microcellular cards include downloadable software preprogrammed on Flash EPROM (FEPRM). Flash EPROM is a nonvolatile storage device that stores the downloadable software. Initially, the loads are programmed by the factory into the FEPRM, and later the contents of the FEPRM can be upgraded with newly downloaded software.

A software download from the Meridian 1 system to a Microcellular card occurs automatically during card initialization (Unlock maintenance operation) only if the contents of the FEPRM are invalid or if software versions do not match between the version number stored in FEPRM and that in the version file on the switch. For Option 11C, the version files are in the directory b:/p/mob. For other options, the version files are in the directory /p/mob.

The download process involves sending software modules from one device to another and might take several minutes. For Options 51C, 61C, 81, and 81C, five distributed processors for the Microcellular system require software downloading: MISP, EIMC, MXC, XPEC, and TRU-II. For Option 11C, which does not use a MISP or XPEC card, the EIMC, MXC, and TRU-II distributed processors require software downloading. The Meridian 1 Core software downloads the following software modules from the system disk:

- MISP: Mobility Routing Application (MOB) and base code
- EIMC: boot/base code and wireless access control software
- MXC: base code and Microcellular Speech Transcoder (MSX) software
- XPEC: enhanced peripheral switching software
- TRU-II: radio software

Downloading during call processing

The distributed processors cannot perform call processing while their own software downloads because downloading requires taking the software out of service. Software for new components can download, however, while existing components perform call processing.

Downloading parameters

Another type of download process, called parameter download, involves downloading parameters to devices for device configuration and operation.

Configuration parameters

During configuration of the Microcellular components, the cellular operator enters the following configuration parameters for the Microcellular system:

- Maintenance Heartbeat period between the CMCP and the Meridian 1 system, usually a number of days
- Operator number and zone identification

- Radio frequencies and other operational parameters for cells, including the following parameters:
 - System operator code
 - SID
 - PSID
 - Alpha PSID
 - SS_SUFF
 - DVCC for the control channel and voice channels
 - VMAC/DMAC (power level)
 - MS_ACC_PWR
 - RS_ACC_MIN
 - SERV_SS
 - Handoff Threshold
- Parameters for AFP regions, including the following parameters:
 - Uplink RSSI Threshold
 - Downlink RSSI Threshold
 - Backup Channel List Size
 - Statistical Analysis Interval
 - Statistical Analysis Threshold
 - Convergence Pass Threshold
 - Intercell Adjacent Channel Separation
 - Intracell Adjacent Channel Separation
 - Control Channel BER Threshold

- Parameters for external cells, including the following parameters:
 - Mode
 - CHAN
 - DVCC
 - DCC
 - MS_ACC_PWR
 - SS_SUFF
 - RSS_ACC_MIN
- Parameters for neighbor cells, including the following parameters:
 - CHAN
 - DVCC
 - RESEL_OFFSET
 - SS_SUFF
 - DELAY
 - HI_FREQ
 - CELLTYPE
 - Network Type
 - MS_ACC_PWR
 - RSS_ACC_MIN
 - DCC

You cannot unlock a Microcellular cell, zone, or AFP region until the cellular operator completes its configuration. For information about the configuration procedures, see “Configuring Microcellular components” on page 179 and Appendix D: “Cellular operator guide” on page 293.

The cellular operator administers the configuration parameters and downloads parameters to the Meridian 1 system in the following situations:

- When the Microcellular system installer asks the cellular operator to complete the zone, cell, and AFP region configuration for system initialization.
- When a CMCP connects to a Meridian 1 system during a cold start, if the Meridian 1 has no configuration data for the Microcellular system
- When configuration details change at the CMCP
- When the CMCP IP address or modem details change at the Meridian 1 system

EIMC and MXC parameters

The Meridian 1 Core software is the primary repository of Microcellular information. During the operation of the Microcellular system, however, the EIMCs, MXCs, and TRU-Is need timely access to Microcellular information. Some transient Microcellular data resides on the EIMC and MXC devices. During EIMC initialization, the Meridian 1 Core software downloads to the EIMC information that the EIMC and MXC devices require. This information includes a representation of the configuration of some portions of the Microcellular system.

Setting up the MAT

This section describes how to set up the connection to a Meridian 1 Microcellular system through a Meridian Administration Tool (MAT). The MAT consists of a PC running MAT 5.7+ software, connected to a Meridian 1 serial port.

Installing MAT hardware and software

If a local MAT is not installed for a Meridian 1 system, you need to install one, ensuring that the security device is installed on the parallel port. You can also install a remote distributor MAT, with the security device.

“Configure maximum number of portables” on page 339 provides some information about installing a MAT. For complete information on MAT installation, see the *Meridian Administration Tools Common Services User guide* (A0658266).

Installing MAT software

Before you install the Mobility System Management software for the Microcellular system, make sure that the following MAT software is installed:

- MAT Common Services End User Package or MAT Common Services Distributor Package
- MAT System Administration Module

Follow the installation instructions that come with the software. For additional instructions, see the *Meridian Administration Tools Common Services User guide* (A0658266).

Installing the MAT connection to the Meridian 1 system

The connection between the local MAT and the Meridian 1 system is through Ethernet. If the network communications cable for this connection is not yet installed, you need to install it. For information about installing the Ethernet connection, see the *Meridian Administration Tools Common Services User guide* (A0658266)

The connection for a remote distributor MAT is through dial-up modems (PPP) and PSTN. If the serial communications cable for this connection is not yet installed, you need to install it. For information about setting up a modem for a remote MAT connection, see “Configuring modems for CMCP or MAT access” on page 61.

Installing Mobility System Management software on a MAT

The Microcellular system includes Meridian 1 applications and MAT-based applications. The MAT gives you access to Meridian 1 Microcellular applications.

Before you add and configure the Meridian 1 system on the MAT, install the Mobility System Management (MSM) application from the CD-ROM or diskettes. Follow the instructions that come with the software or the instructions in the *Meridian Administration Tools Common Services User guide* (A0658266) for installing applications.

The MSM software uses CORBA for communicating between the Meridian 1 system and the MAT. An ORBIX daemon process, ORBIXD, must be running on the MAT before you can access the Mobility System Management application. MAT installation ensures this by placing ORBIXD in the operating system startup folder.

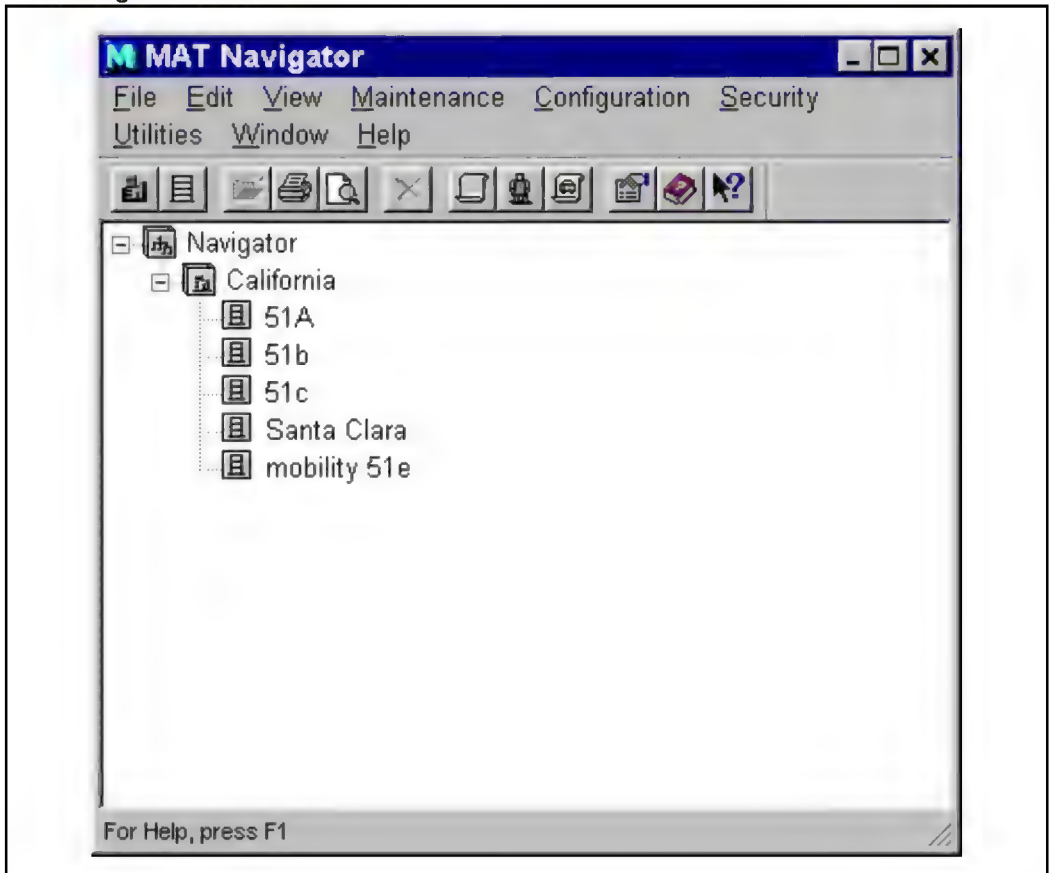
Configuring MAT access to the Meridian 1 system

To configure MAT access to the Meridian 1 system, you need to add the system, enter the configuration values, and enable MAT applications for the system through the MAT Navigator window:

- 1 To start the MAT software, select **MAT** in the Start menu **Programs** list.
- 2 In the MAT login dialog box, enter your MAT user ID and password and click **OK**.

This opens the MAT Navigator window, which Figure 8 illustrates.

Figure 8
MAT Navigator window



The Navigator window contains icons that represent Meridian 1 sites. You can expand the tree to display systems within each site.

For more information about the MAT Navigator window, see the *Meridian Administration Tools Common Services User guide* (A0658266).

- 3** Select **Add Site** from the **Configuration** menu.

This opens a property sheet for the site.

- 4** Fill in all the fields and click **Apply**.

- 5 Click the **Add System** bar.
- 6 When the MAT prompts for a system type, **Meridian 1** or **Other**, select **Meridian 1**.

This opens the System property sheet, which Figure 9 illustrates. (To open the property sheet for a system, highlight the system in the MAT Navigator window and choose **Properties** from the **File** menu, or click the right mouse button.)

Figure 9
System property sheet, General page

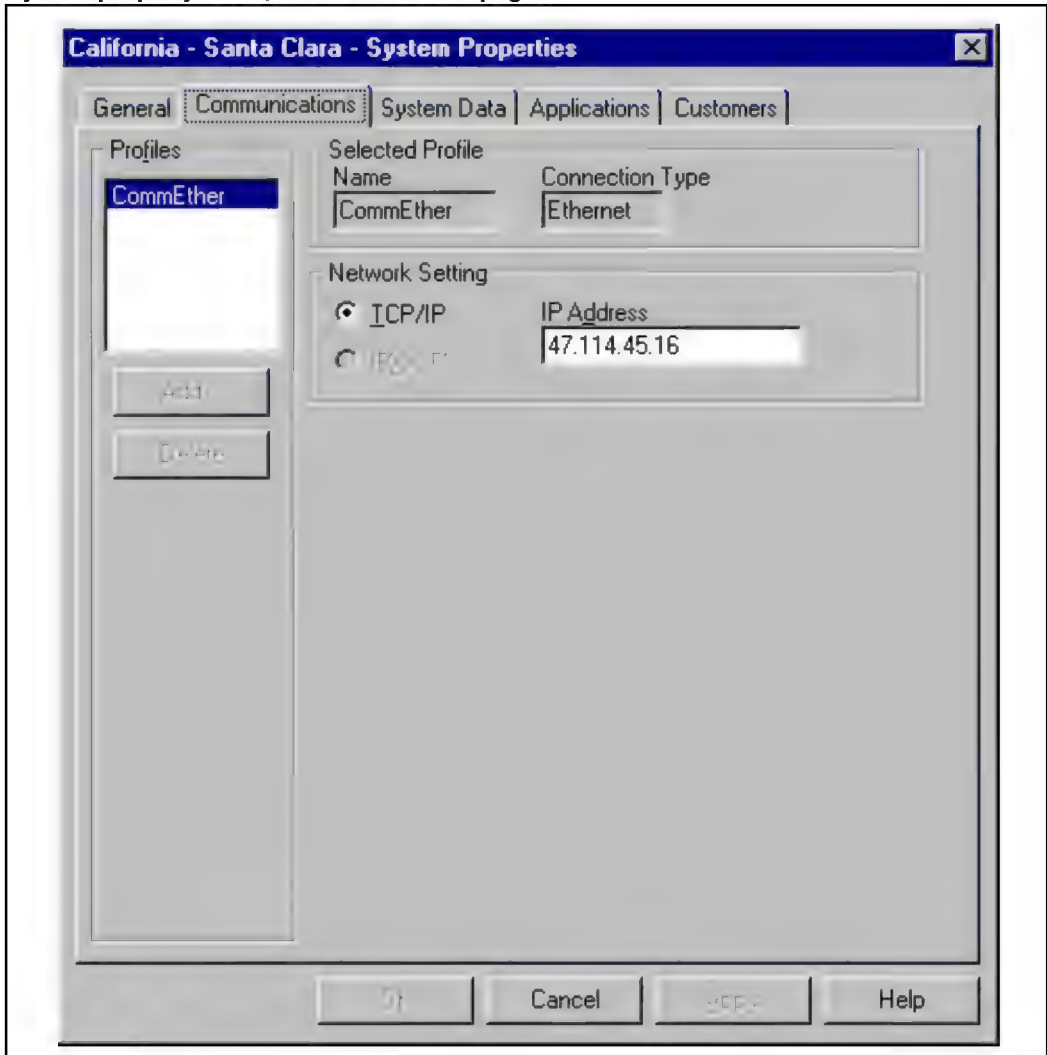
The screenshot shows a Windows-style dialog box titled "California - Santa Clara - System Properties". It has five tabs: "General" (selected), "Communications", "System Data", "Applications", and "Customers". The "General" tab contains the following fields and options:

- System Name:** Santa Clara
- Short Name:** 51A
- System Type:** (dropdown menu)
- System Location:**
 - ☐ Same as Site
 - Address:** (text field)
 - City:** (text field)
 - State/Province:** (text field)
 - Country:** (text field)
 - Zip/Postal Code:** (text field)
- Contact Information:**
 - ☐ Same as Site
 - Name:** (text field)
 - Phone Number:** (text field)
 - Job Title:** (text field)
 - Comments:** (text area)

At the bottom of the dialog box are four buttons: "OK", "Cancel", "Apply", and "Help".

- 7 On the General page, fill in the fields and click **Apply**.
- 8 Click the **Communications** tab to go to the Communications page, which Figure 10 illustrates.

Figure 10
System property sheet, Communications page



- 9** Click **Add**.
- 10** Select a connection type.
- 11** Fill in the fields, including **IP Address**, and click **Apply**.

- 12 Click the **System Data** tab to go to the System Data page, which Figure 11 illustrates.

Figure 11
System property sheet, System Data page

California - Santa Clara - System Properties

General | Communications | **System Data** | Applications | Customers

Machine Information

Machine: 51C Release: 23

Issue: 0 System ID: Cutover Date: 9/18/1997

System Parameters

Maximum Speed Call Lists: 0 Maximum ACD Agents: 0

☐ MARP allowed ☐ Multiple Loop DN

Packages

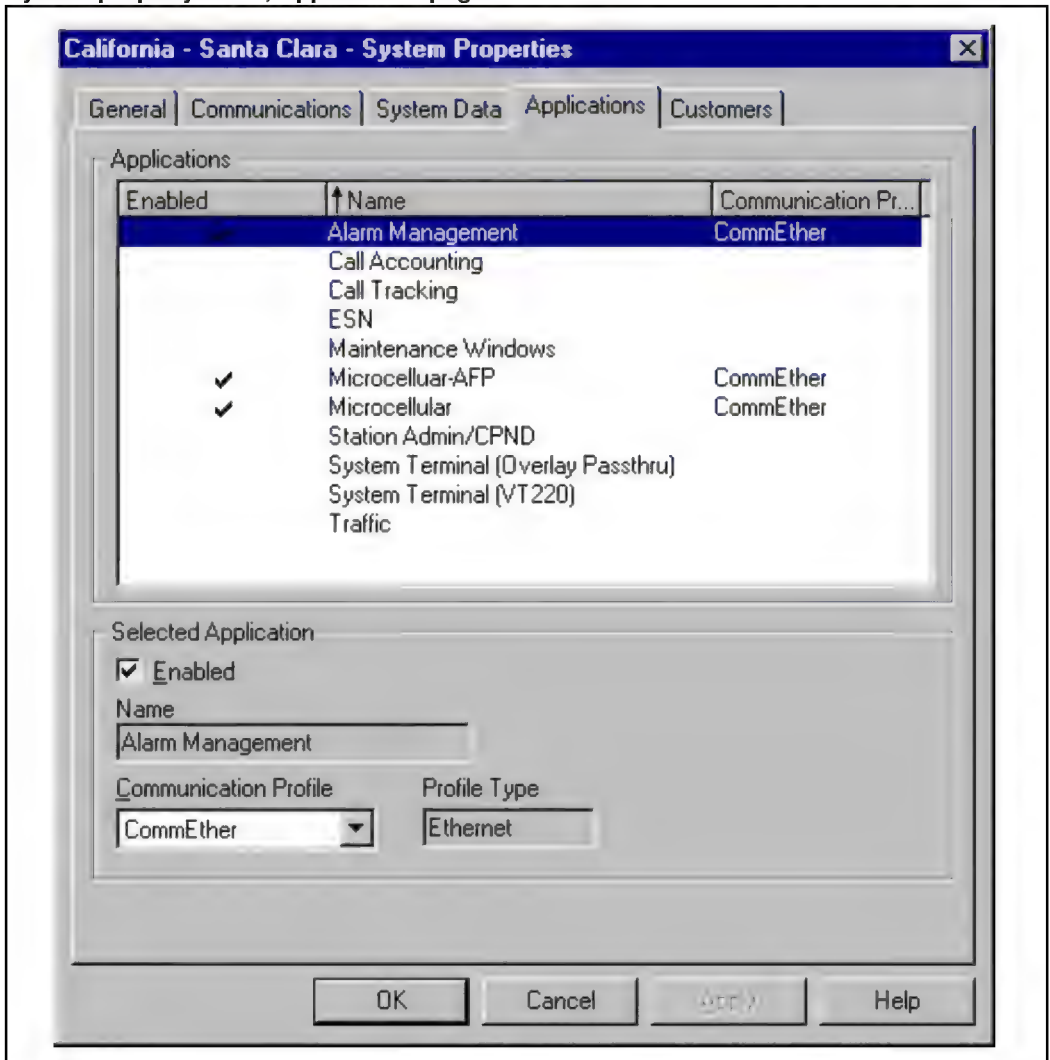
Enabled	Opt	Code	Description
☒	1	OPTF	Extended PBX Features
☒	2	CUST	Multi-Customer
☒	3	AIOD	Auto. Inden. of Out. Dial
☒	4	CDR	Call Detail Recording
☒	5	CTY	CDR - TTY
☒	6	CLNK	CDR - Mag. Tape
☒	7	CLNK	CDR - Mag. Tape

Enable All Disable All

OK Cancel Apply Help

- 13 Fill in the **Machine** and **Release and any other** fields and click **Apply**.
- 14 Click the **Applications** tab to go to the Applications page, which Figure 12 illustrates.

Figure 12
System property sheet, Applications page



- 15 Select **Microcellular**, **Microcellular-AFP**, and any other MAT applications that you want to enable for the system.

You probably also need the **Alarm Management** application to monitor Microcellular alarms, the **System Terminal (Overlay Passthru)** application to configure a MISP card for the Microcellular system (“Configuring a MISP card” on page 195), and **Station Admin/CPND** to configure portables (“Configuring portable telephones” on page 251).

- 16 Click **Apply**.
- 17 Close **OK** to close the property sheet.

An icon that represents the added Meridian 1 system should appear in the MAT Navigator window. If it does not, try closing the window and reopening it. If the icon still does not appear, check the physical connection to the Meridian 1 system, fix any problems, and repeat the configuration procedure.

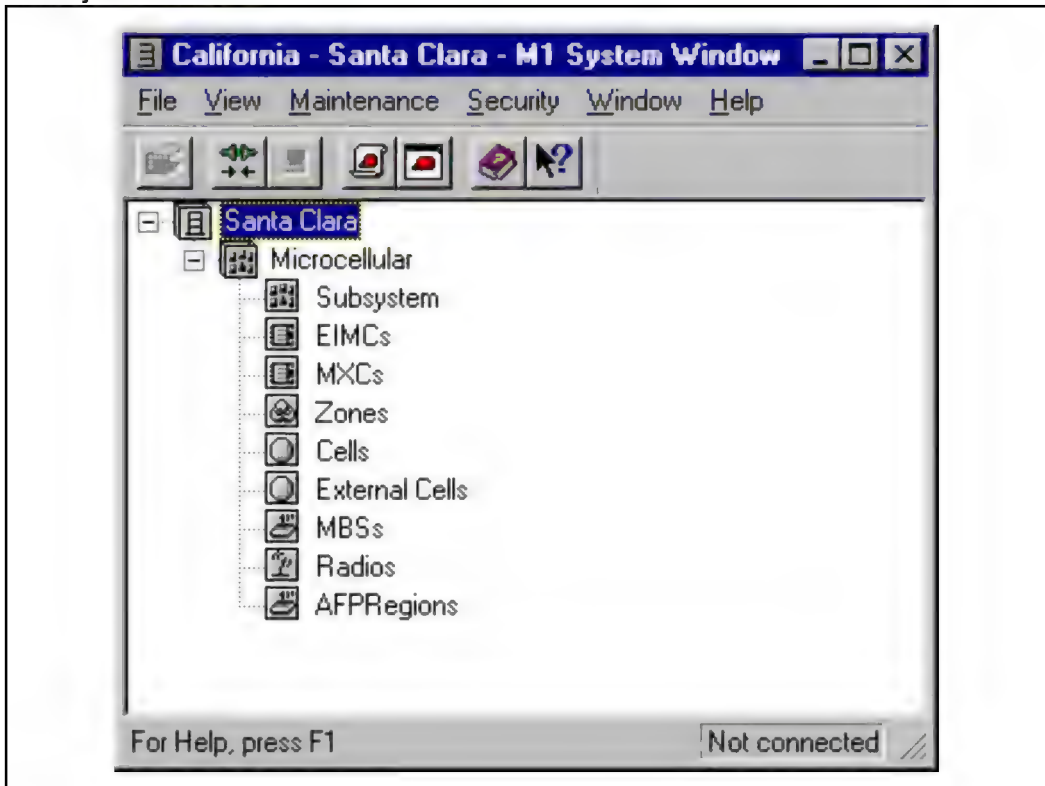
Verifying the communications link to the Meridian 1 system

To verify the communications link to the Meridian 1 system, connect the MAT to the system:

- 1 In the MAT Navigator window, double-click the Meridian 1 system icon, or highlight the system icon and select **Open** from the **File** menu.
- 2 In the Meridian 1 login dialog box, enter your Meridian 1 user ID and password.

This opens a MAT System window for the Meridian 1 system, which Figure 13 illustrates.

Figure 13
MAT System window



The System window gives you access to Microcellular object managers. The object manager icons in this window represent the Microcellular subsystem within the Meridian 1 system. You can use the object managers to add, configure, and unlock Microcellular components, as later sections of this guide describe.

If the Microcellular icon does not appear in the System window, you need to give the MAT access to the Microcellular system on the System Property sheet (select **Properties** from the **File** menu).

From the System window, you can launch applications that require a connection to the Meridian 1 system. You can also launch an overlay pass-

through or a terminal emulation application to provide character-based access to the Meridian 1 system.

A System window might include applications other than those provided for Microcellular management (for example, Maintenance Windows and ESN Analysis and Routing Tool).

Configuring modems for CMCP or MAT access

This section describes how the Celco Mobility Control Point (CMCP) communicates with the Microcellular system through a modem connection to the Meridian 1 system. You can use the same kind of modem connection for a remote distributor MSM MAT.

The Microcellular system reuses the frequency spectrum from the existing macrocellular system. The cellular service provider controls the use of its voice channels and control channels within each Microcellular system through the CMCP, located at the cellular company site. At the private system side, a number of Microcellular zones are attached to a Meridian 1 system, which provides the interface to communicate with the CMCP.

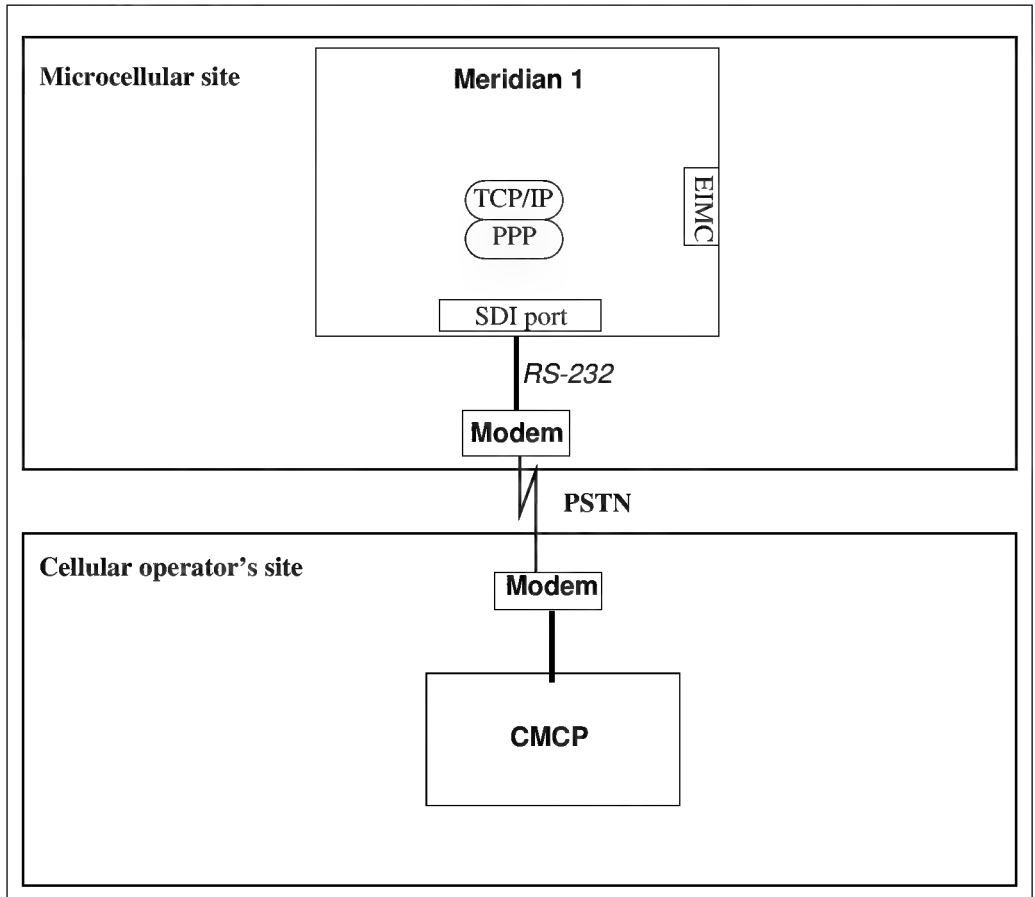
Each Meridian 1 system with a Microcellular system has a dial-up link to a CMCP. Before a Microcellular system can operate, the cellular operator needs to complete the configuration of Microcellular zones, cells, and AFP regions, including the voice-channel and control-channel frequencies and radio parameters for Microcellular system. While a Microcellular system operates, it returns a keep-alive heartbeat sent by the CMCP.

Through a Meridian 1 system, the CMCP establishes the connection with the Microcellular system, reestablishes the connection if it is lost, and initiates communications with the Microcellular system.

As Figure 14 shows, the CMCP communicates with the Meridian 1 system by using PPP over a serial link to a modem, with TCP/IP. The Meridian 1 SDI port can reside either on the SDI card or on the MSDL card, port 0. The MSDL SDI Handler must support block-mode transfer for its SDI port to serve as the connection point.

Note: Do not use the core serial port for the CMCP connection (Option 61C, 81, or 81C).

Figure 14
Meridian 1 to CMCP connectivity



The cellular service provider sets up the CMCP at its cellular company site. For information about setting up the CMCP, see “Configure maximum number of portables” on page 339.

To establish communications over a point-to-point link, the PPP server in the Meridian 1 Core software must configure the Microcellular end of the PPP

link, and the router PPP stack in the CMCP must configure the other end. Each end of the PPP link must pass data link tests that the PPP server and the router PPP stack run.

A CMCP can connect to multiple Meridian 1 systems. The CMCP establishes communications with each Meridian 1 at configured time intervals to send and receive a keep-alive heartbeat. To invoke the Meridian 1 PPP, the CMCP sends commands that provide the login sequence and start the Meridian 1 PPP session.

The CMCP is responsible for the communications link establishment and reestablishment. It attempts to connect and communicate with a Meridian 1 system via the dial-on-demand mechanism.

For information about installing a modem for remote access, see the *Meridian Administration Tools Common Services User guide* (A0658266).

After installing and configuring the dial-up link, the distributor needs to provide the following dial-in access information to the cellular operator.

- Modem DN
- Meridian 1 user ID
- Meridian 1 password

The distributor also needs to ask the cellular operator to verify the dial-in link to the Meridian 1 system from the CMCP. The cellular operator can verify the link by connecting to the Meridian 1 system. (See “Connecting to a Microcellular system” on page 337.)

For more information about the CMCP, see Appendix D: “Cellular operator guide” on page 293.

Installing the antenna structure

A Microcellular system can have antennas configured in many ways, with different numbers of Microcellular Base Stations and TRU-IIs to suit different environments.

Figures 15 through 18 provide examples of some possible antenna configurations. The output of the MBS has four antenna ports. The TRU-IIs in the MBS can transmit and receive signals simultaneously through all antennas within a cell.

In a configuration with more than one antenna, each MBS “multicasts” all of its radios to each antenna that connects to the MBS.

With the use of the appropriate hybrid(s), either Dual 8-Port or Quad 4-Port, all TRU-IIs in up to four MBSs can simulcast their available RF channels to all antennas within the cell.

Coaxial cables run from the antennas to the hybrids or directly to the MBS RF antenna cables. The MBS RF antenna cable converts an MBS TNC antenna port to an N-style antenna connector.

Figure 15
One antenna with one MBS and four distributed antennas with one MBS

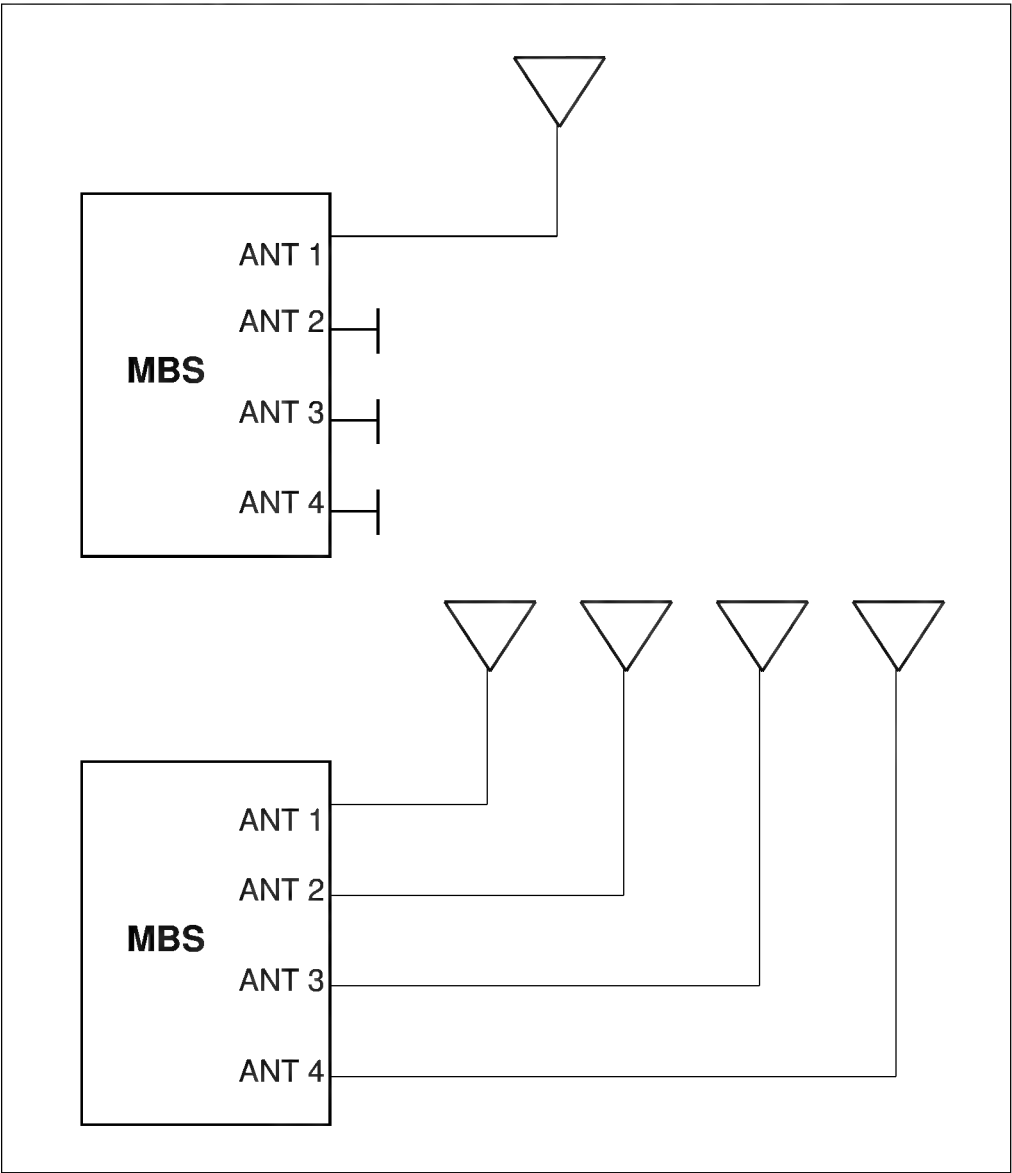


Figure 16 and Figure 17 show how you can combine two MBSs or four MBSs through hybrids to share antennas. Figure 18 shows a configuration in which four MBSs share 16 antennas (using hybrids) for more coverage.

Figure 16
Eight antennas with two MBSs using one Quad 4-Port Hybrid

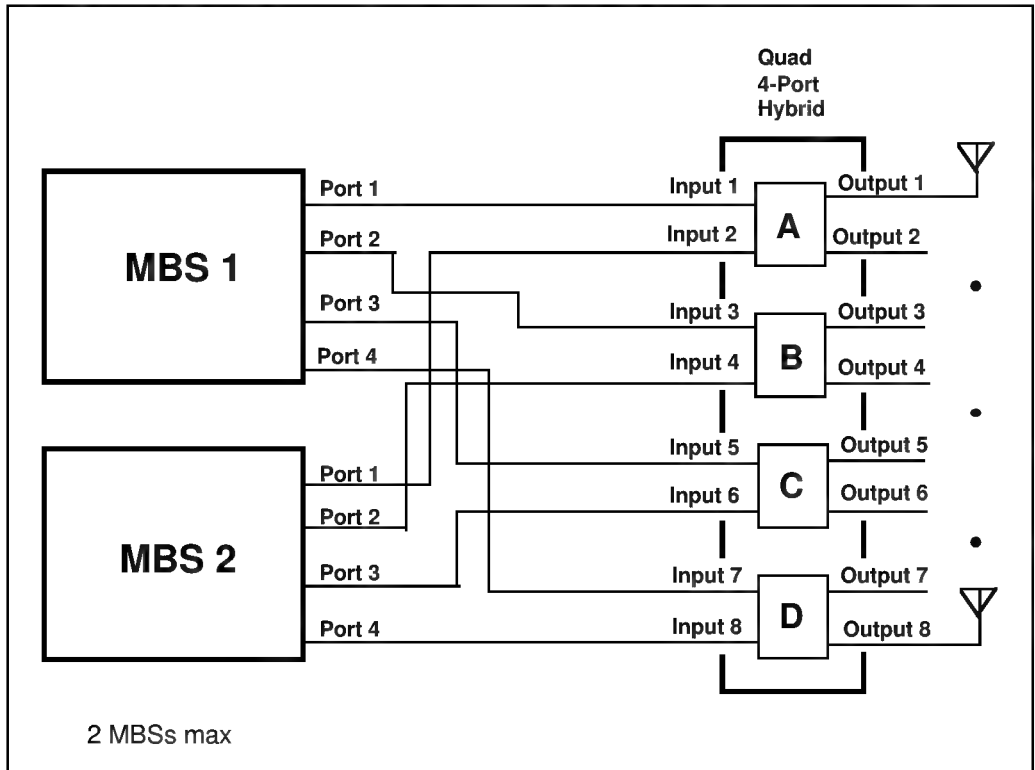


Figure 17
Four MBSs with two antennas using one Dual 8-Port hybrid

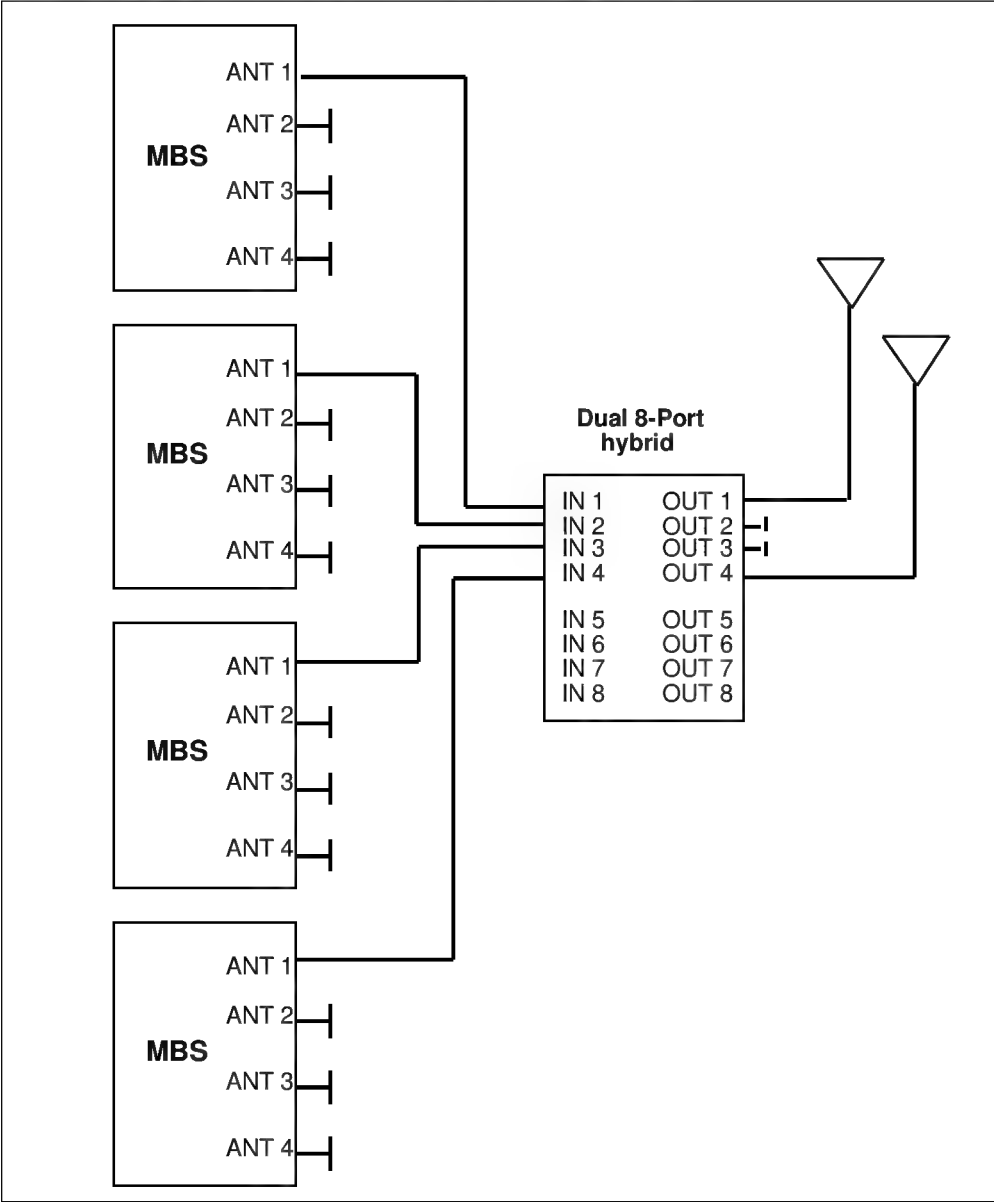
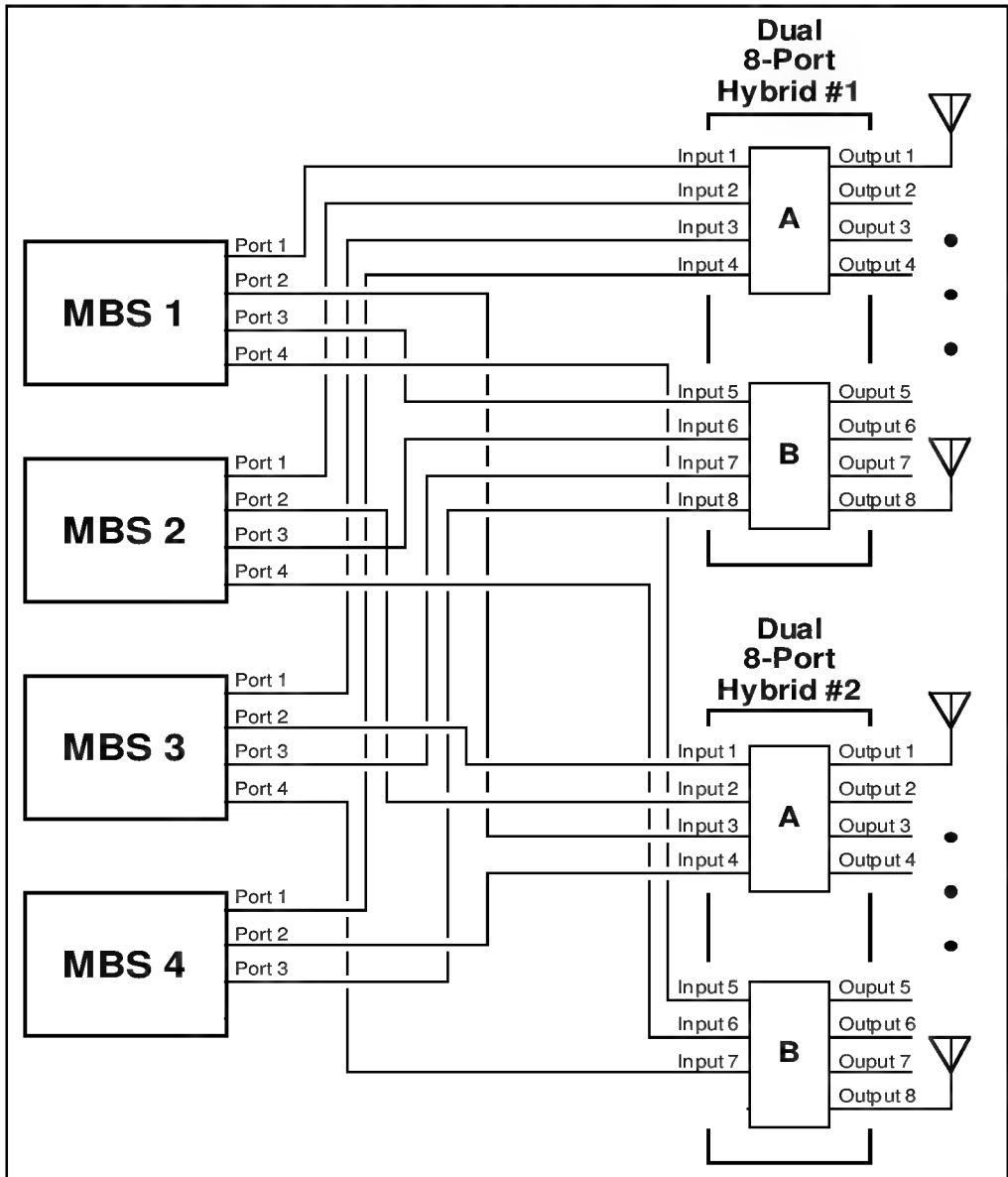


Figure 18
Four MBSs with 16 antennas (up to 15 TRU-IIs) using two Dual 8-Port hybrids



Preparing for antenna installation

Installing the antenna structure requires many tools and supplies as well as floor plans and cabling information.

The customer must supply lightning surge protectors for any outside antennas.

Tools and supplies

Nortel recommends the following tools for cable and antenna installation:

— Basic tools:

- Knife
- Hammer
- Pliers
- Wrenches: 9/16 in., 19/32 in., 11/16 in., 13/16 in., 3/4 in., two 21 mm, one 24 mm, and one adjustable torque wrench
- Fine-toothed hacksaw or jeweler's saw
- Flat file
- Wire brush
- Thin, angled wire snips
- 1,000-watt heat gun
- Soldering iron (minimum 400 watts)
- Portable work bench

— Supplies:

- Solder: 63/37 RMA flux core
- Tape
- Garnet cloth (240 or finer)
- Damp cloth
- Solvent: nonflammable cleaning fluid
- For each hybrid, six 2.5 in. #10 wood screws

— Workstation for cable-connector assembly

An established workstation is essential for carrying out cable-connector assembly procedures efficiently and with quality results.

- You need a work bench with a clamping vise that has a jig that can securely hold the cable without crushing it. Any sturdy, portable work table should do the job.
- Good lighting is a must. If the work space does not have sufficient lighting, use a portable lamp.
- The work space must be clean. It is important that dirt does not get inside the cable-connector assembly.

— Specialty tools:

- Andrew cable-cutting tool (Andrew part #207866)
- Andrew pin alignment tool (Andrew part #224360), used to straighten a pin and to orient it to the conductor correctly
- Andrew pin depth gauge for N-Male connectors (Andrew part #224380), used to establish that a pin is set to the correct depth inside the connector
- Andrew pin soldering pliers (Andrew part #224377), used to hold the contact pin during soldering
- Resistance soldering iron, which is preferable to a normal soldering iron because it heats faster, provides greater heat, and is easier to use. If this is not an option, use an industrial or heavy-use soldering iron.

Site planning documents

To determine antenna locations and cable routing, refer to the site planning documents. The annotated site floor plans should indicate where to install each antenna, with a range of tolerance for adjustments.

You need the following documents for antenna installation:

- Floor plans for the site, complete with antenna locations, cable routing and location tolerances, sketches of the MBS and Meridian 1 locations, and locations of the different cells in each Microcellular zone
- An antenna system connectivity chart or charts (see Appendix C)
- An equipment list for provisioning the Microcellular hardware, cables, cards, and installation supplies
- A labeling scheme for the cables and connectors
- Maximum cable lengths for each size of cable in each cell

Note: If you do not have these documents, or if the floor plans and charts do not include this information, obtain it from the site planner.

Try to carry out the installation when no one is in the building. Coaxial cable can be stiff and unwieldy, and you might need to mount antennas in offices or in high traffic areas. Carrying out the installation after hours avoids conflict with normal work activities.

MBS and hybrid locations

The indoor antenna system is split up into a number of different cells. Each cell has a designated central location for its Microcellular Base Stations (MBSs) and hybrids. This is most likely a telecommunications closet. Coaxial cables connect the antennas to this central location.

Cell coverage area

The maximum cell coverage area depends on the RF characteristics in the area, such as obstructions, and also on cable size, application, and antenna configuration. Smaller cables have higher loss and therefore less coverage. For example if the site has 200,000 sq ft (60,960 sq m) and is in a low interference area, two cells are required for an eight-antenna system using 3/8 in. or 1/2 in. cable. If the site has about 10,000 sq ft (3,048 m), a single antenna system can easily cover the site for both high-interference and low-interference areas.

You can achieve these cell sizes in most topological layouts by using 3,000 ft (914 m) TCM lines between each MBS and the Meridian 1 system or IPE

shelf. The coaxial cable lengths are normally about 100 ft (30 m) for 1/4 in. coax, 225 ft (68.5 m) for 3/8 in. coax, and 350 ft (107 m) for 1/2 in. coax.

WARNING

These instructions are exclusively for indoor applications. The Microcellular system does not support outdoor antenna applications, except where antennas are located in protected areas, such as under eaves, and proper site deployment procedures have been followed.

Installing cables, hybrids, and antennas for a cell

The following steps describe how to install the antenna structure for one cell. Later subsections provide detailed instructions. Repeat the installation procedure for each cell of every zone in the Microcellular system.

- 1** Select a cell from the floor plans. Make sure that you have all the installation components, documentation, and supplies that you need to install the cables, hybrids, and antennas for the cell. (See “Preparing for antenna installation” on page 70.)
- 2** Find the location of the MBS or MBSs for the cell, probably a telecommunications closet. Set up a portable work bench in the closet, with a clamping vise and a lamp.
- 3** Run the coaxial cable for the cell:
 - a** In the telecommunications closet, choose the cable size that the floor plan specifies. Attach a connector to the antenna end of the cable and label that end.
 - b** Run the cable to the antenna location.
 - c** Return to the telecommunications closet, cut the cable to the specified length, attach the other connector, and label this end of the cable.
 - d** Repeat steps a through c for every antenna location in the cell. Dress the cable where appropriate.
- 4** If the configuration uses one or more hybrids, mount each hybrid to a backboard in the telecommunications closet, within 6 ft of the location of any MBS that will connect to the hybrid.

If the telecommunications closet does not have a plywood backboard on which you can mount hybrids, first follow the instructions under “Installing a backboard” on page 114..

- 5 Connect the cable ends to the appropriate output ports on the hybrid or hybrids.

For a configuration that does not use a hybrid, you will connect the cable ends after you install the MBS.

- 6 At each antenna location in the cell, mount the specified antenna and connect the other ends of the cables to the antenna.

Use the floor plans to determine where to place each antenna.

Installing coaxial cable for antennas

For all configurations, the distributed antennas connect to the Microcellular Base Stations through coaxial cables. The customer (site planner) has three choices of cable size: 1/4 in., 3/8 in., or 1/2 in. The thinner cables cost less and are easier to install; however, they offer higher loss (and therefore smaller cells). Nortel recommends 1/2 in. cable for the best cost/performance ratio. The site planner determines which antenna system configuration is suitable for the site based on the coverage and the area of the site. In general, more antennas provide more coverage but require more cable runs.

Note: Check local safety, fire, and building code regulations before ordering or installing cable.

These instructions describe connectors for connecting antennas to MBSs through hybrids to which the MBS-to-hybrid cables are attached. Hybrids are optional. Your site plan might specify connecting the antennas directly to the MBSs.

The specified coaxial cable and connectors are examples only. Generally, you can use any high-performance, low-loss 50-ohm cable. For more information, check the cable manufacturer's specifications.

Running cables between antennas and hybrids

To install the coaxial cables that connect the antennas to the hybrids, you need to cut lengths of cable, run each cable length between the antenna and hybrid locations, and attach connectors to the cable ends.

This method describes cutting lengths of cable from a reel of bulk cable. Before running the cables between the antenna and hybrid (or MBS) locations for a cell, determine the appropriate size of cable from the floor plans and set

up a cable reel on a spindle in the telecommunications closet. Inspect the cable for possible damage.

Note: Do not pull the cable off the end of a coil or reel; doing so can result in a twisted cable that would be very difficult to work with. Set the reel up on a spindle that lets the reel spin.

CAUTION

Do not pull on twisted cable. This could cause it to kink. If the cable becomes kinked, it must be discarded.

All the cables have a minimum bending radius—see Table 1. Be careful not to bend the cable so sharply that you fall below the minimum bending radius. Tight bends should be made over a mandrill.

Table 1
Minimum bending radius

Cable	Nominal diameter	Diameter over jacket	Minimum bending radius
FSJ1-50A	0.25 in.	0.29 in.	1 in.
ETS1-50T	0.25 in.	0.29 in.	1 in.
HS1RP-50	0.25 in.	0.29 in.	1 in.
LDF2-50	0.375 in.	0.44 in.	3.75 in.
ETS2-50T	0.375 in.	0.415 in.	1 in.
FSJ4-50B	0.5 in.	0.52 in.	1.25 in.
LDF4-50A	0.5 in.	0.63 in.	5 in.
FT4-50T	0.5 in.	0.60 in.	5 in.
HL4RP-50	0.5 in.	0.60 in.	5 in.

To install the coaxial cable in a cell, complete the following steps for each antenna:

- 1 At the cable reel in the telecommunications closet, fresh cut the end of the cable.
- 2 Attach the appropriate connector, as described under “Assembling cables and connectors” on page 77. Label the end of the cable according to its designation in the connectivity chart. Cover the end of the connector with protective fabric.

Note: It might be impossible to run the cable with the connector attached. In this case, run the cable to the antenna location, leaving some slack, and then attach the connector at the antenna end.

- 3 Run the cable to the antenna location. The marked-up floor plans should show the cable route.

You should normally run the cables in cable trays or conduits. This is standard installation practice. If you want to run the cables along a different route—for example, over the ceiling—you need the permission of the landlord. It is often a breach of fire code regulations to let cable lay in free space or on top of ceiling tiles.

Note: Check local safety, fire, and building code regulations before ordering or installing cable.

In many situations you need to cut a hole in a false ceiling to feed the cable to the antenna location. Cut a 1.25 in. (3 cm) hole approximately 8 in. (20 cm) from the back of the antenna location.

- 4 Secure the cable along the route where appropriate.
- 5 At this point the cable is still part of the reel. In the telecommunications closet, cut the cable to a length that it is long enough to reach the hybrid location. Avoid splicing the cable because splices can cause signal loss.

Note: Remember that the other connector still has to be attached to this end. Make sure the cable hangs down low enough for it to be worked on.

There are maximum cable lengths for the different size cables that run from the hybrid to the antenna. It is possible that the designer made a mistake in measuring the length of the cable or that there might be unforeseen complications in which you might have to run more cable than specified. These maximum lengths should be detailed on the floor plan.

WARNING

Should a situation occur where you are going to exceed the maximum length for a particular size of cable, do not continue.

- If you exceed the maximum length of the 1/4 in. cable, you can substitute 3/8 in. or 1/2 in. cable, provided the maximum length for the substitute is not exceeded.
 - If you exceed the maximum length of the 3/8 in. cable, you can substitute 1/2 in. cable, provided its maximum length is not exceeded.
 - For 1/2 in. cable there are no substitutions. Stop work and phone the site planner.
- 6** Attach the other connector. Label the end of the cable according to the designation it has been given in the connectivity chart.

Assembling cables and connectors

The Microcellular antenna system can use up to seven different cables and five different connectors. This document provides part numbers for cables and connectors from Andrew Corporation for convenience, although you can use any supplier's cables or connectors as long as they conform to the specifications provided.

Table 2 lists connectors that you can use with each type of cable.

Table 2
Cables and connectors

Cable description	Andrew cable #	Andrew connector #	Nortel Connector #
1/4 in. Heliax superflexible standard jacket	FSJ1-50A	F1PNM-H (41PW)	A0382258
1/4 in. Heliax superflexible plenum	ETS1-50T	F1PNM-H (41PW)	A0382258
1/4 in. Heliax air dielectric plenum	HS1RP-50	F1PNM-H (C41SW)	A0382258
3/8 in. Heliax foam dielectric standard jacket	LDF2-50	L2PNM (L42PW)	A0615484
3/8 in. Heliax foam dielectric superflexible, plenum	ETS2-50T	F2PNM (42SPW)	A0621669
1/2 in. Heliax superflexible standard jacket	FSJ4-50B	F4PNM (44SEW)	A0615483
1/2 in. Heliax foam dielectric standard jacket	LDF4-50A	L4PNM (L44PW)	A0381727
1/2 in. Heliax air dielectric plenum	HL4RP-50	L4PNM (L44PW)	A0381727

WARNING

This section provides sample instructions for the cable-connector assembly. For the actual cable-connector assembly procedures, consult the instructions that your cable supplier provides.

Assembly workstation, tools, and supplies

The assembly of cables and connectors requires several basic tools and supplies. An established workstation is essential for carrying out the assembly procedures efficiently and with quality results. Some specialty tools can make the job easier and faster and result in more reliable assemblies.

For lists of the basic tools and supplies, workstation requirements, and specialty tools, see “Tools and supplies” on page 70.

Cable-connector assembly procedure

The following assembly procedure contains 16 steps. Familiarize yourself with the procedure before attempting any cable-connector assemblies.

WARNING

It is essential that the cable-connector assembly be properly carried out—failure to do so could result in system failures.

1 Prepare the cable

If you are using the Andrew cable-cutting tool, follow the instructions that came with the tool for. Otherwise, proceed with the following instructions to prepare the cable for assembly with the connector.

Before you begin, situate the portable work bench in an area with enough working space and adequate lighting.

- a** Straighten at least 10 in. of the working end of the cable. Trim 1 in. off this end of the cable with a pair of cable cutters to provide a fresh working edge. The cutters must be sharp or they will crimp the cable.

Note: Crimping the cable, even slightly, is not acceptable. If you happen to crimp the cable, cut off the crimped section and start again.

- b** Put the freshly cut end in the vise so that you have about 2.5 to 3 in. of cable to work with. Make sure you are using a jig to secure the cable so that you do not crimp it.
- c** Use a sharp knife to remove some of the jacket and expose the outer conductor. See Figure 19 and Table 3 for the amount of jacket to remove. Be careful not to cut the outer conductor. Remove any burrs on the outside edge of the outer conductor, then clean the outer conductor with solvent.

Figure 19
Cable with jacket removed

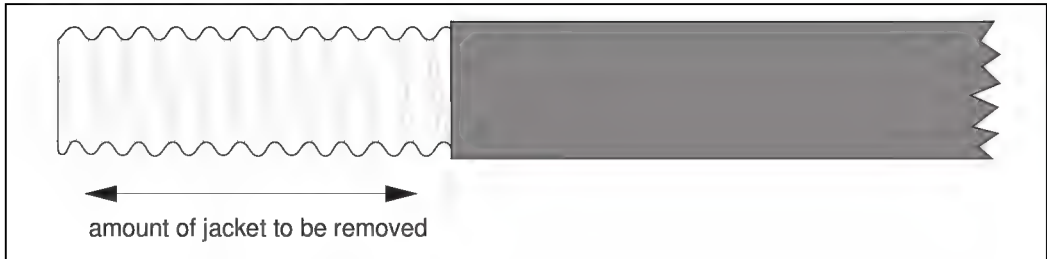
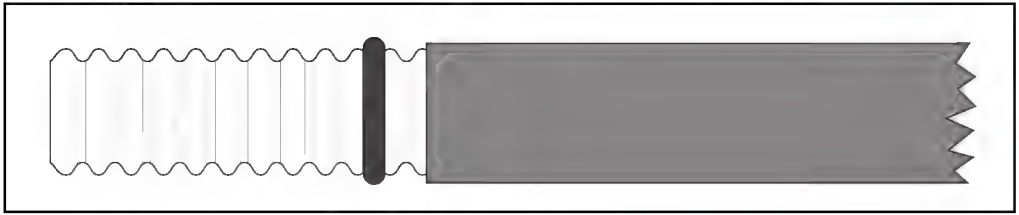


Table 3
Amount of jacket to remove

Cable description	Cable number	Jacket to remove
1/4 in. Heliax superflexible standard jacket	FSJ1-50A	7/8 in. (2.223 cm)
1/4 in. Heliax superflexible plenum	ETS1-50T	7/8 in. (2.223 cm)
3/8 in. Heliax foam dielectric standard jacket	LDF2-50	1-1/4 in. (3.175 cm)
3/8 in. Heliax foam dielectric superflexible, plenum	ETS2-50T	1-1/2 in. (3.81 cm)
1/2 in. Heliax superflexible standard jacket	FSJ4-50B	1-1/2 in. (3.81 cm)
1/2 in. Heliax foam dielectric standard jacket	LDF4-50A	2 in. (5.08 cm)
1/2 in. Heliax foam dielectric plenum	FT4-50T	2 in. (5.08 cm)
1/2 in. Air dielectric plenum	HL4RP-50	2 in. (5.08 cm)

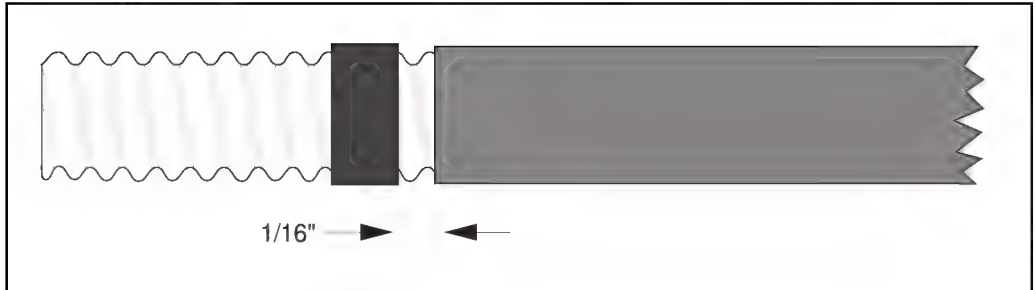
- 2 **Set the O ring or gasket:** Depending on the cable-connector you are assembling, do either of the following:
 - Put the O ring on the second fully exposed conductor groove as measured from the jacket, as Figure 20 shows.

Figure 20
Cable with O ring



- Put the gasket on the conductor about 1/16 of an inch from the jacket, as Figure 21 shows.

Figure 21
Cable with gasket

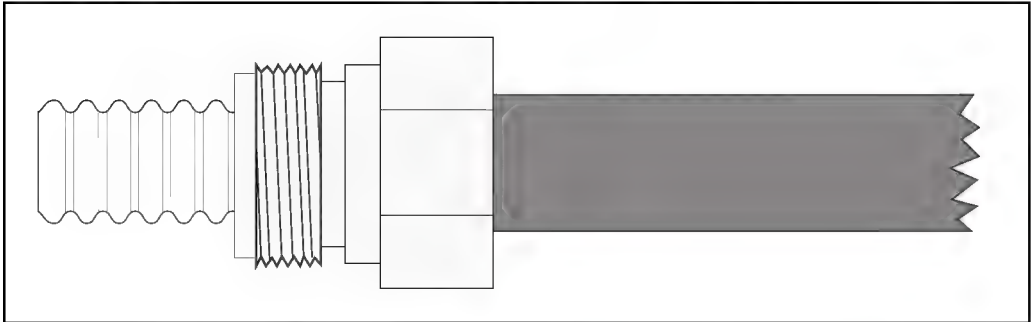


Note: When putting the gasket on, slide the smooth end of the gasket over the conductor first, being careful not to rip it on the conductor, then make sure it is sitting flat on the conductor.

Lightly grease the O ring/gasket and the inner surface of the clamping nut with silicone. Be careful to apply the silicone only to the desired areas.

- 3 **Screw on the clamping nut:** Hand thread the clamping nut onto the outer conductor, then use a wrench to tighten it into place. Figure 22 illustrates a clamping nut on a cable.

Figure 22
Clamping nut



- 4 **Trim the outer conductor:** Trim the outer conductor so that only the desired amount is left showing (see Figure 23 and Table 4). Use a hacksaw or jeweler's saw to cut through the outer conductor. Use a guide to ensure a straight cut because it is important that the cut be parallel to the edge of the clamping nut. Pull the excess off with a pair of pliers.

Figure 23
Trimming the outer conductor

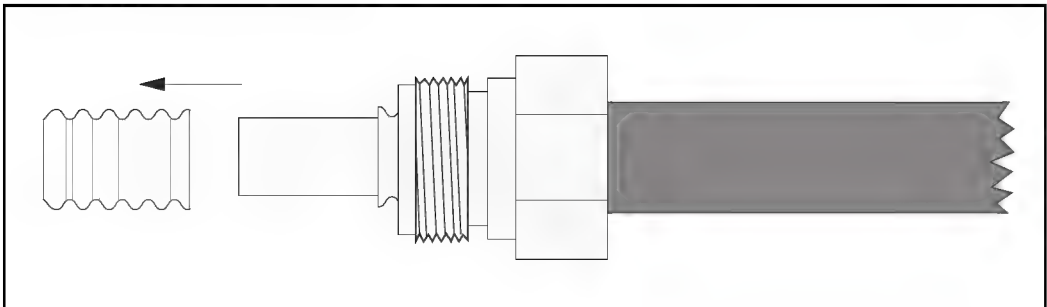


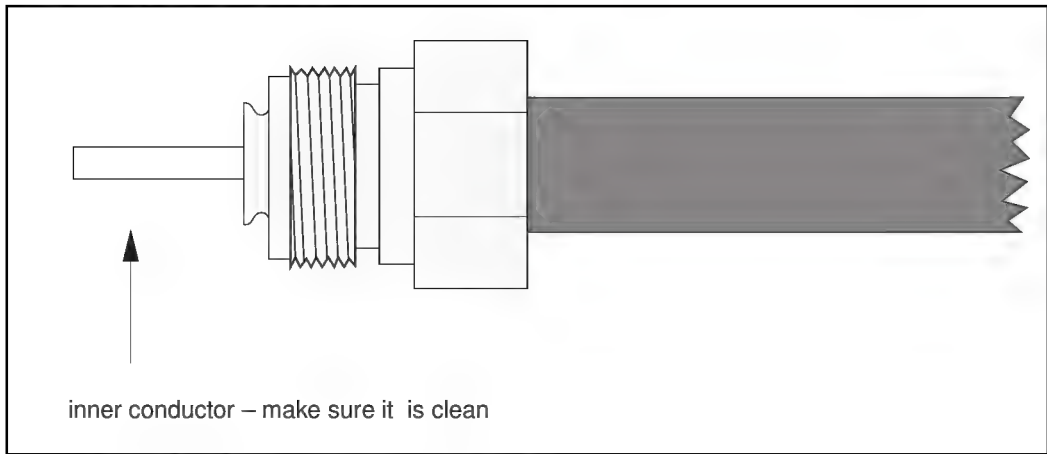
Table 4
Outer conductor

Cable description	Cable number	Connector	Amount showing
1/4 in. Heliax superflexible standard jacket	FSJ1-50A	F1PNM-HF (41PW)	1/16 in. (0.159 cm)
1/4 in. Heliax superflexible plenum	ETS1-50T	F1PNM-HF (41PW)	1/16 in. (0.159 cm)
3/8 in. Heliax foam dielectric standard jacket	LDF2-50	L2PNM (L42PW)	flush
3/8 in. Heliax foam dielectric superflexible, plenum	ETS2-50T	F2PNM (42SPW)	1/32 in. (0.079 cm)
1/2 in. Heliax superflexible standard jacket	FSJ4-50B	F4PNM (44SEW)	1/16 in. (0.159 cm)
1/2 in. Heliax foam dielectric standard jacket	LDF4-50A	L4PNM (L44PW)	flush
1/2 in. Heliax foam dielectric plenum	FT4-50T	L4PNM (L44PW)	flush
1/2 in. Heliax air dielectric	HL4RP-50	L4PNM	flush

- 5 Remove the foam:** Clean all the foam off the inner conductor with a knife. Be careful not to scrape the inner conductor. Use the garnet cloth to remove the adhesive and to ensure that the surface is clean, as Figure 24 shows.

Note: The surface must be residue free. Leftover foam can interfere with setting the pin on the conductor and can reduce conductivity.

Figure 24
Cable with foam removed



- 6 Cut the inner conductor:** Use a hacksaw or jeweler's saw to cut the inner conductor to the desired length (see Figure 25 and Table 5). Deburr the cut end with a file.

Figure 25
Sizing the inner conductor

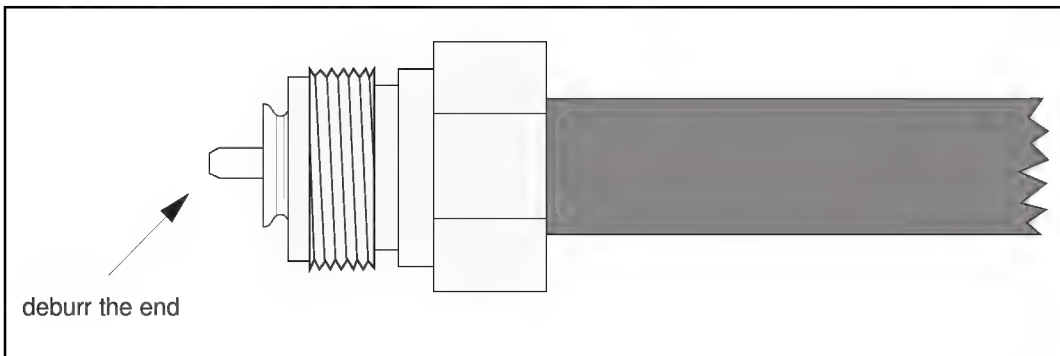


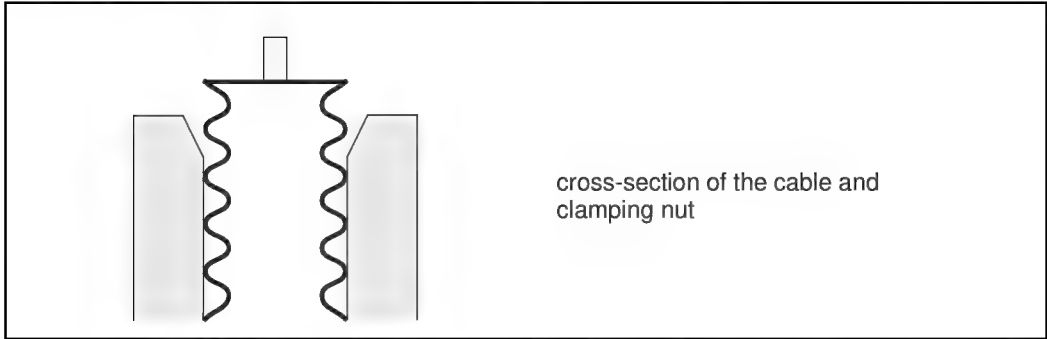
Table 5
Inner conductor

Cable description	Cable number	Connector	Inner conductor length
1/4 in. Heliax superflexible standard jacket	FSJ1-50A	F1PNM-HF (41PW)	1/4 in. (0.635 cm)
1/4 in. Heliax superflexible plenum	ETS1-50T	F1PNM-HF (41PW)	1/4 in. (0.635 cm)
3/8 in. Heliax foam dielectric standard jacket	LDF2-50	L2PNM (L42PW)	3/16 in. (0.476 cm)
3/8 in. Heliax foam dielectric superflexible, plenum	ETS2-50T	F2PNM (42SPW)	7/32 in. (0.219 cm)
1/2 in. Heliax superflexible standard jacket	FSJ4-50B	F4PNM (44SEW)	3/16 in. (0.476 cm)
1/2 in. Heliax foam dielectric standard jacket	LDF4-50A	L4PNM (L44PW)	7/32 in. (0.219 cm)
1/2 in. Heliax foam dielectric plenum	FT4-50T	L4PNM (L44PW)	7/32 in. (0.219 cm)
1/2 in. Air dielectric	HL4RP-50	L4PNM	7/32 in. (0.219 cm)

- 7 Clean the foam:** Use a small brush to clean all the dirt and metallic particles off the foam. The particles and dirt interfere with the signal traveling through the cable.
- 8 Separate foam from the outer conductor:** (This is not necessary in the 1/4 in. cable-connector assemblies.) Gently separate the foam from the outer conductor. Insert the tip of a knife between the foam and the outer conductor to a depth of 1/16 in. and separate them so that the outer conductor can be flared. Scrape away any foam clinging to the outer conductor and remove any burrs from the inside edge. Use a small brush to clean the foam again, if necessary.
- 9 Flare the outer conductor:** The 1/4 in. cable-connector assemblies, FSJ1-50A/41PW and ETS1-50T/41PW, require the outer conductor to be manually flared against the clamping nut, as steps 9a through 9f describe. Step 10 on page 90 describes how to flare the 3/8 in. and 1/2 in. cable-connector assemblies. Figure 26 depicts the cable emerging from the clamping nut.

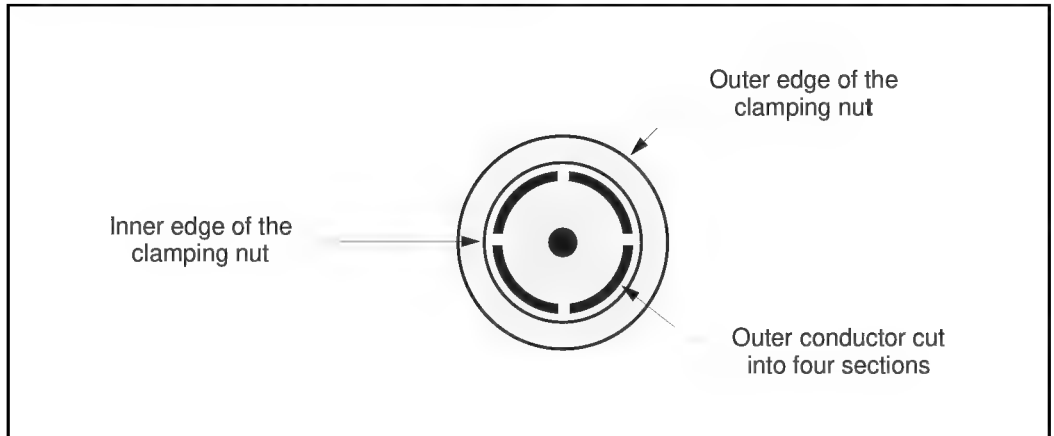
Note: This is a complex procedure—you should read all the steps before starting.

Figure 26
Cable and clamping nut



- a** Use a pair of thin, angled wire snips to vertically cut the outer conductor into four equal sections—see Figure 27.

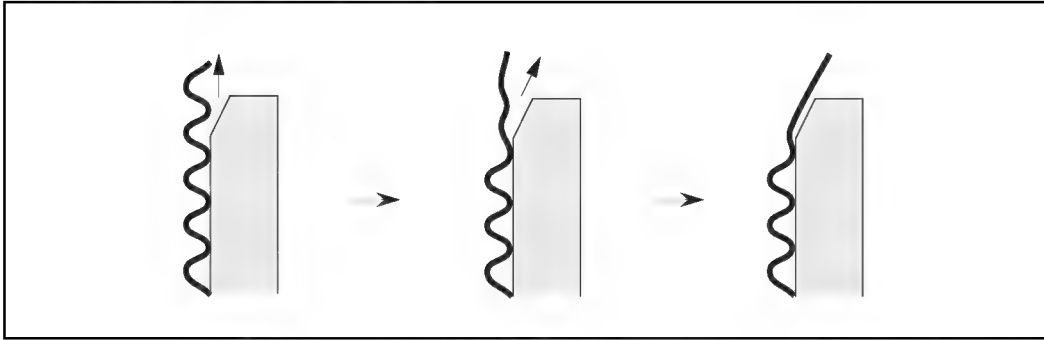
Figure 27
Top view of outer conductor and clamping nut



- b** Use the snips to clamp the individual sections of the outer conductor (being careful not to cut through them) and to gently pry or lift them slightly upwards and outwards.

As Figure 28 shows, this step is used to straighten the corrugation out of the metal and then to align it with the inside beveled edge of the clamping nut.

Figure 28
Straightening the outer conductor



WARNING

If you pull too hard, the conductor will tear—see Figure 30 for an example of what a tear looks like.

If you do not lift and pull the sections up and outwards, it is difficult to seal the connector properly. The corrugated shape of the inner conductor makes it difficult to work with. This step helps to make it easier to seal the sections against the clamping nut.

- c Cut the four sections in half so that there are eight sections.
- d Roll the eight sections back over the clamping nut. The objective is to create a perfect seal between the outer conductor and the clamping nut. Figure 29 details a cross-section of what the end product should look like.

This step is very tricky. The sections need to be delicately molded against the clamping nut. Smooth down any irregularities and close all the gaps between the eight sections inside the inner edge of the clamping nut. The thin tips of the side snips are useful in shaping the inner conductor.

Note: It is possible that you might tear the outer conductor. This is unacceptable. Small gaps are normal; they are a result of the cutting process and can be smoothed together with the snips. Tears are larger than small gaps and cannot be smoothed together. See Figure 30 for a distinction between the two.

Figure 29
Properly flared outer conductor

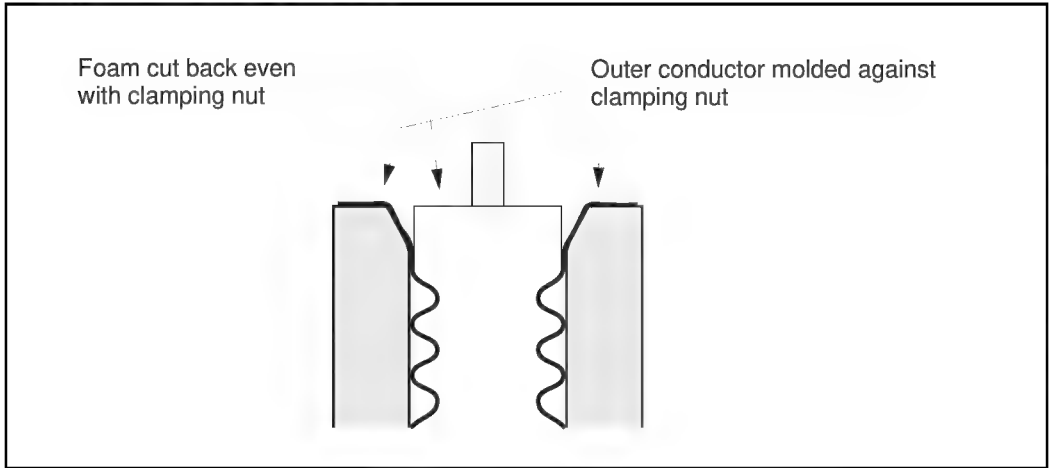
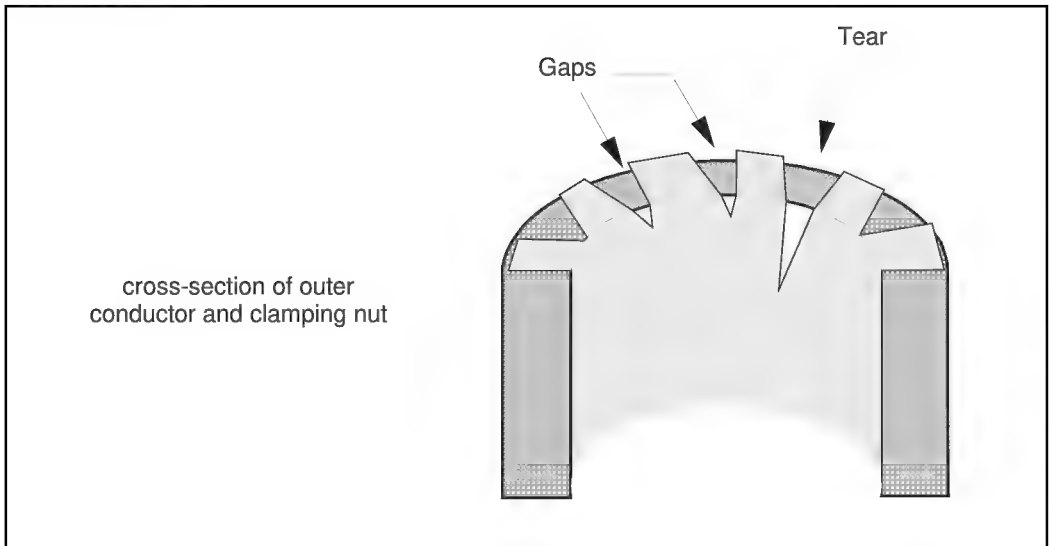


Figure 30
Gaps and tears



If the tear is shallow, you can tighten the clamping nut until the tear surfaces above the edge of the clamping nut—after this all you need to do is start the flaring process over again, making sure that you remember to measure and recut the inner conductor. If the tear is deep, you will have to remove the clamping nut and start the cable-connector assembly over again.

- e The sections of the outer conductor that overlap the clamping nut need to be hammered flat against the clamping nut. If any of the tabs protrude past the outside edge of the clamping nut, trim off the excess.
- f Cut and scrape away the excess foam. Proceed to step 10.

10 Flaring 3/8 in. and 1/2 in. cable-connector assemblies: The 3/8 in. and the 1/2 in. cable-connector assemblies, LDF2-50/L42PW, ETS2-50T/42SPW, FSJ4-50B/44SEW, LDF4-50A/L44PW, and FT4-50T/L44PW are designed to be self-flaring:

- a Slip the outer body of the connector over the clamping nut and tighten to the appropriate torque using a set of wrenches—see Table 6 on page 93 for the appropriate torques. The flaring surface of the outer body will flatten the outer conductor against the clamping nut.
- b Disassemble the connection and inspect the flare to ensure that there is good metal-to-metal contact. If it is not correctly flared, repeat the procedure.

11 Putting the pin (inner connector) on the inner conductor:

For this step, it is necessary to have a tool to hold the pin. Pliers or visegrips are not a good choice unless the teeth are covered with fabric, a brass template, or tin foil so that the pin does not get scratched. A simple holder can be made from a clothespin by drilling a hole in the clamping end so that there is a groove in which the pin can sit itself.

CAUTION

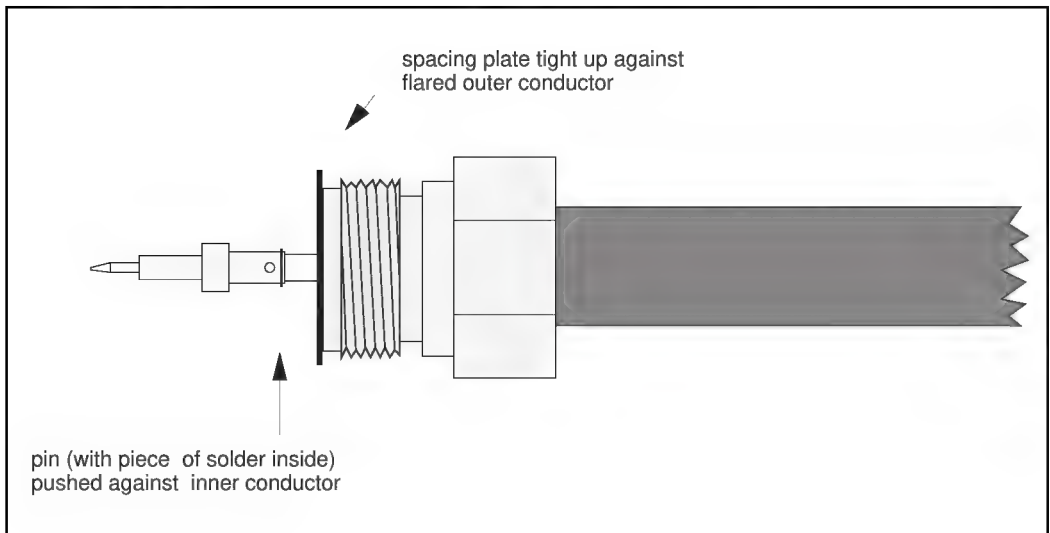
Scratching the surface of the pin is unacceptable. Pin deformation will affect system performance.

The connector assembly kit comes with a thin spacing plate. You use this to set the distance between the pin and the outer conductor. It also shields the dielectric foam from excess heat. Before soldering the pin to the inner conductor, place the spacing gauge over the inner connector tight up against the outer conductor-clamping nut.

Complete the following:

- a Cut a piece of solder equal in length to the inner hole of the pin.
- b Place the piece of solder in the pin. Then place the pin against the end of the inner conductor and apply a little pressure. (See Figure 31.)

Figure 31
Soldering pin



- c Heat up the pin with the soldering iron; as the pin heats up, it will melt the solder. The pin will then slide over the inner conductor. Hold for a second longer to ensure that a cold solder joint does not occur.

Note: By putting solder in the pin, you ensure a good connection and you will not accidentally melt any foam by trying to maneuver the soldering iron around the end of the pin.

It is important to push the pin on as far as it can go. Any excess solder will seep out through the holes on the side of the pin. This is an indicator that there was enough solder and that there was good melt. The excess must be trimmed off. It can be gently scraped off with a knife or, if it has bubbled, clipped off with a set of wire snips. The snips can sometimes do a quicker and cleaner job than the knife.

CAUTION

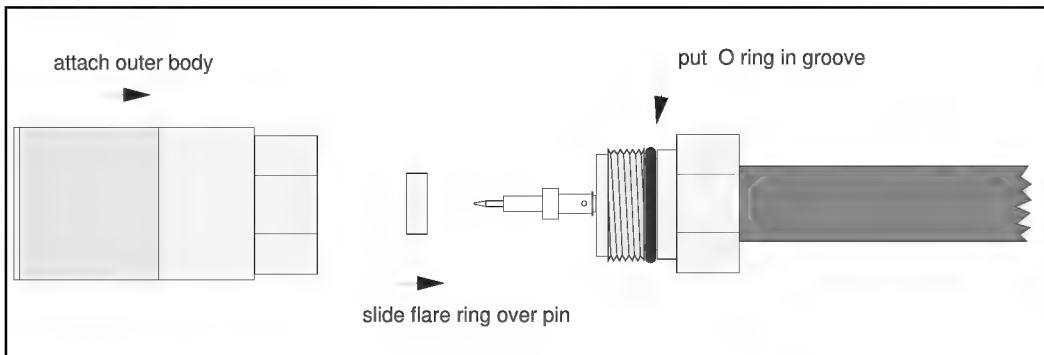
Be careful not to scratch the pin when trimming off the excess solder.

It is important to make sure that the pin is aligned with the axis of the cable.

d Remove the soldering iron from the pin.

- 12 Add O ring and grease:** Slide the second O ring onto the groove on the clamping nut and apply a thin coat of silicone grease. Keep all connector threads free of grease.

Figure 32
Final assembly



13 Attach outer body (and flare ring if necessary):

Note: The 1/4 in. connectors have a flare ring that must be inserted into the outer body before it is threaded onto the clamping nut.

Thread the outer body onto the clamping nut and tighten the connection with wrenches—see Figure 32. Do not turn the clamping nut to tighten, turn only the outer body until secure. To ensure a proper connection, use a torque wrench and tighten to the required torque—see Table 6.

Table 6
Required torque for clamping nut

Cable description	Cable number	Connector	Required torque
1/4 in. Heliax superflexible standard jacket	FSJ1-50A	F1PNM-HF (41PW)	48 in./lb (4 lbs/ft)
1/4 in. Heliax superflexible plenum	ETS1-50T	F1PNM-HF (41PW)	48 in./lb (4 lbs/ft)
3/8 in. Heliax foam dielectric standard jacket	LDF2-50	L2PNM (L42PW)	48 in./lb (4 lbs/ft)
3/8 in. Heliax foam dielectric superflexible, plenum	ETS2-50T	F2PNM (42SPW)	96-144 in./lb (12.2 ± 2.2 lbs/ft)
1/2 in. Heliax superflexible standard jacket	FSJ4-50B	F4PNM (44SEW)	96-144 in./lb (12.2 ± 2.2 lbs/ft)
1/2 in. Heliax foam dielectric standard jacket	LDF4-50A	L4PNM (L44PW)	142-146 in./lb (12.2 ± 0.2 lbs/ft)
1/2 in. Heliax foam dielectric plenum	FT4-50T	L4PNM (L44PW)	142-146 in./lb (12.2 ± 0.2 lbs/ft)
1/2 in. Air dielectric plenum	HL4RP-50	L4PNM	142-146 in./lb (12.2 ± 0.2 lbs/ft)

Note: If the pin is askew, you will have difficulty putting the outer body on the clamping nut. Straighten the pin out slightly and the outer body should go into place.

14 Check pin alignment: Look at how the pin sits inside the outer body. It should be centered. If it is not, slide the pin alignment tool over the pin and center it.

- 15 Check pin depth:** Use the depth gauge to check the setting of the pin. The gauge shows whether the contact pin is positioned within tolerance limits. The gauge is pushed onto the pin assembly, and a plunger rises to indicate if the pin is installed between the upper and lower tolerance limits. If the pin depth is outside of the tolerances, take off the outer body and check the pin.

If the pin exceeds the upper tolerance limit, reheat the solder and make sure the pin is pushed all the way on. If this is not the source of the problem, check the length of the inner conductor. If the inner conductor is too long, recut the inner conductor. Resolder the pin on and repeat steps 12 to 15.

If the pin is below the lower tolerance level, the length of the inner conductor has been cut too short. Tightening the clamping nut might correct this situation if the inner conductor has not been cut too short. If it has been cut too short, you will have to start the assembly process over again.

- 16 Attach heatshrink (optional):** If any cable runs outdoors (like next to a building or under a covered patio area), you need to attach a black heatshrink sleeve for each connector that you install outdoors. Slide the black heatshrink over the connector and cable; use the heat gun to shrink it into place. Be careful not to melt the heatshrink or the jacket.

Installing hybrids

A cell with 5 to 8 antennas requires only one Dual 8-Port hybrid. A cell with 9 to 16 antennas requires two Dual 8-Port hybrids. (In a cell with 1-4 antennas, hybrids are optional.)

To mount each hybrid, you need six 2.5 in. #10 wood screws.

The Dual 8-Port hybrid (part #A0617460) has inputs and outputs on both sides. The Quad 4-Port hybrid (part #A0617457) has inputs on one side and outputs on the other. There are six screw holes on each hybrid body used for mounting purposes, as Figure 33 and Figure 34 show.

Figure 33
Dual 8-Port hybrid

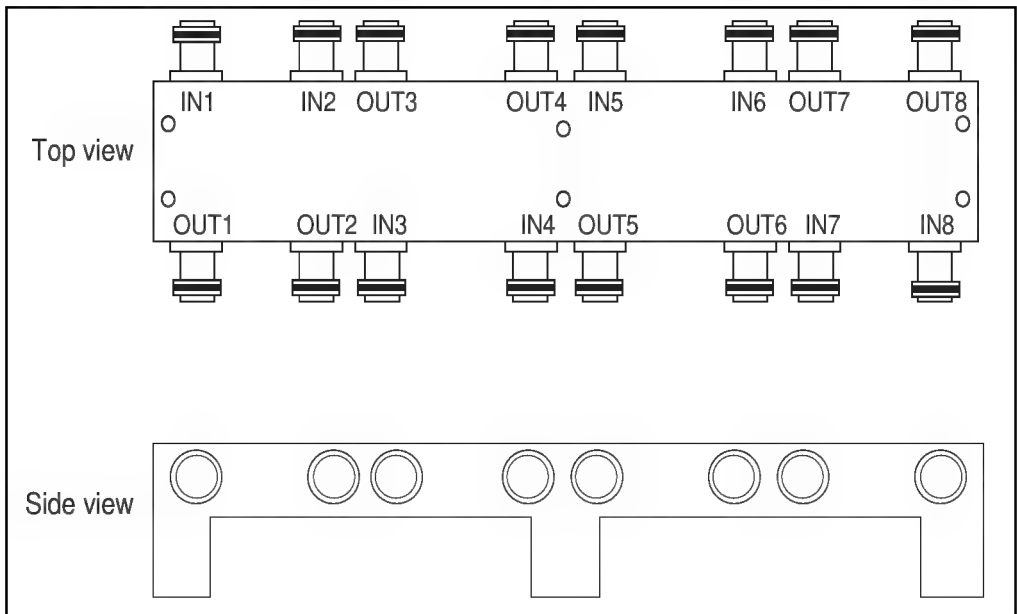
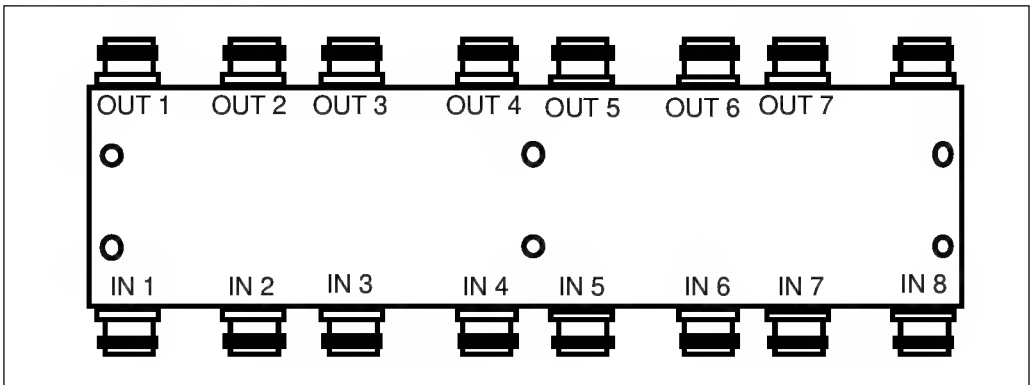
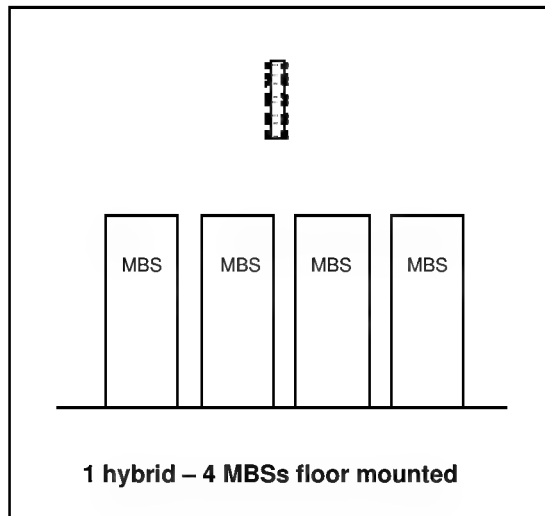
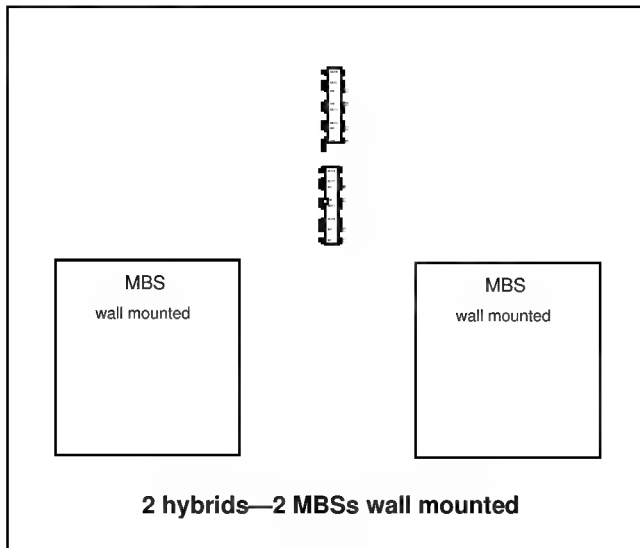


Figure 34
Quad 4-Port hybrid



The cables for connecting the MBSs to the hybrids emerge from the bottom rear of each MBS. The antenna RF cables are approximately 6 feet (1.83 m) long. Because of this cable length, the MBSs and the hybrid(s) must be close to each other. The idea is to mount the hybrid(s) in a location on the backboard where there is enough room to mount up to 4 MBSs nearby so that their cables can reach the hybrid(s). Figure 35 shows two possible setups—the cables are not depicted.

Figure 35
MBS/hybrid configurations



Mount the hybrid(s) vertically rather than horizontally. This vertical mounting prevents any tangling of the cables coming from the MBSs with the antenna cables running down from the ceiling and makes it easier to secure the cables against the backboard.

Note: These are only two possible configurations. You can set up the MBSs and hybrids in other ways.

To install each hybrid, do the following:

- 1 Choose a location for the hybrid so that up to 4 MBSs can be installed nearby with all of their cables able to reach the hybrid. This is dependent upon the layout of the telecommunications closet and equipment already in the closet.
 - For a single hybrid configuration, the hybrid should be situated approximately 2 ft to 2.5 ft off the floor.
 - For a dual hybrid configuration, the first hybrid should be situated approximately 1.5 ft off the floor and the second hybrid right above the first.
- 2 Use the drilling template to mark the screw holes.
- 3 Predrill the holes if necessary, then screw the hybrid(s) to the mounting board.
- 4 Connect the coaxial cables to the hybrids by attaching each cable connector to the appropriate output port on the hybrid and securing the cable to the mounting wall. Group the cables together with cable ties or secure the cables against the backboard with some form of mounting hardware. Tighten the connectors firmly.
- 5 Terminate every unused output port of each active hybrid section with a 50-ohm 1-watt terminators (part number: Nortel A0609689, Andrew 50T-007, MA-COM 3001-6113-00, Radiall, Inc. R404-130, or Huber & Suhner AG 65N-50-0-11/122).

Mounting antennas

The antenna in Figure 36 is square in shape. It has a front and a back, a right side up, and four mounting screws. You need to mount the antenna vertically, right side up, with the front facing the transmission direction.

Figure 36
Directional antenna

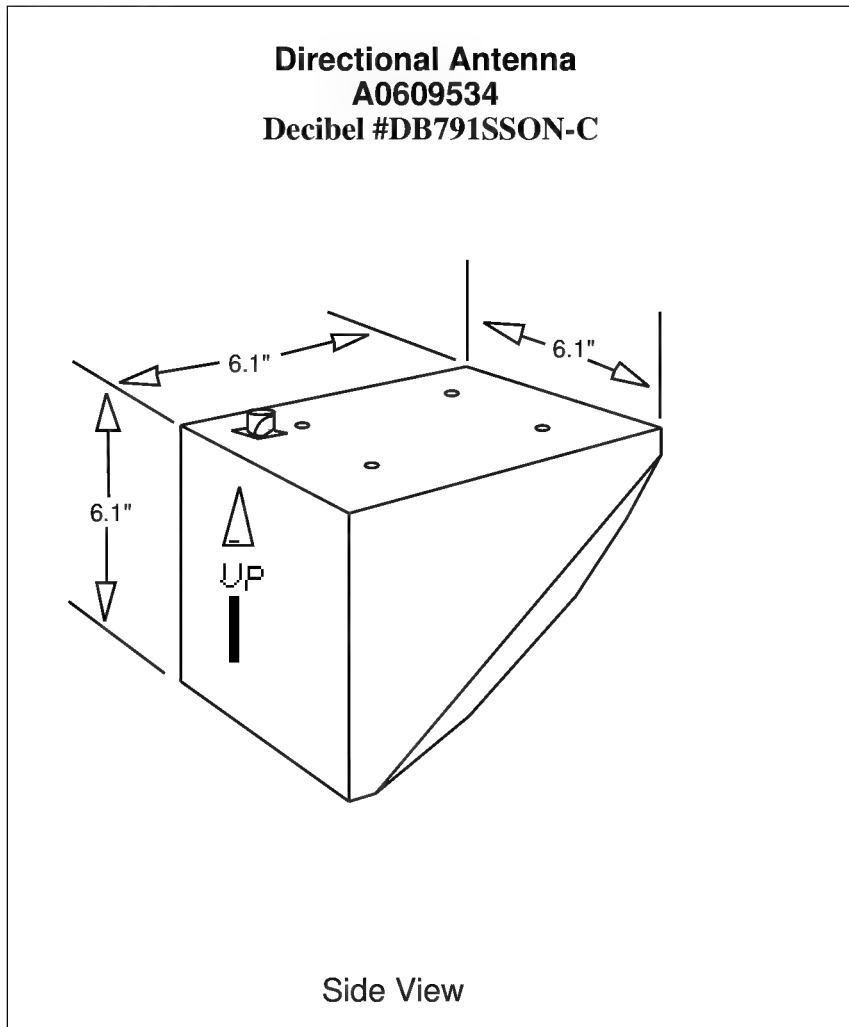
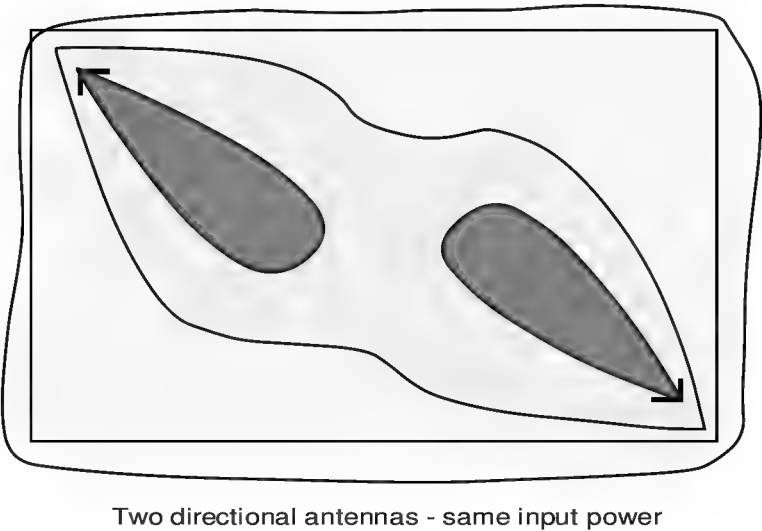
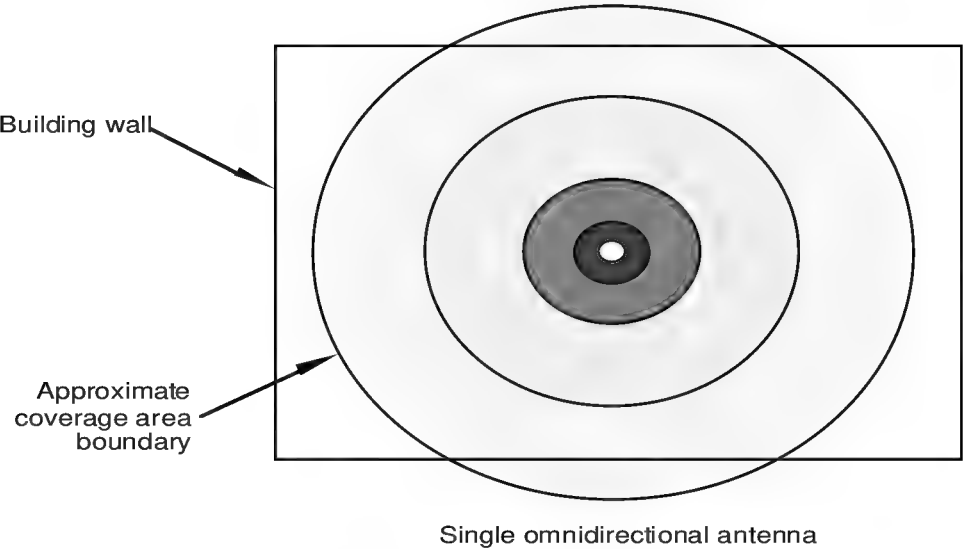


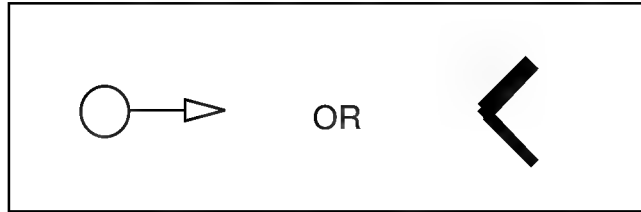
Figure 37 shows the coverage from an omnidirectional antenna and from two directional antennas.

Figure 37
Omnidirectional and directional antennas



The floor plans should indicate the location of each antenna. Figure 38 illustrates the conventions for representing an antenna and its orientation (the direction in which it needs to be aimed).

Figure 38
Antenna iconography



Either of these icons represents an antenna. The location of the icon on the floor plan indicates exactly where to place the antenna. The arrow or the opening of the V indicates the direction the antenna should face. The floor plan should include a tolerance range for each antenna, indicating how much you can deviate from the ideal position if it is impossible to mount the antenna in that exact position.

A Microcellular system has two types of antenna mounts: solid ceiling mount and hidden ceiling mount.

Solid ceiling mount

For a solid ceiling mount, you need two 3/4 in. #10 wood screws.

To mount an antenna to a solid ceiling, perform the following steps:

- 1** Note the location of the antenna on the floor plans and the direction it is supposed to face.
- 2** Check to see if there are any obstructions. Make adjustments if necessary, but stay within the tolerances stated on the floor plan.
- 3** Use the mounting flange on the antenna to mark the screw holes on the ceiling and the hole for the coaxial cable connector.

- 4 Predrill the holes if necessary, then screw the antenna in place, starting with the screws above the antenna. You might need to use washers. It is important that the antenna be screwed on tightly enough so that it cannot accidentally move around.

Note 1: For surfaces that do not accept wood screws (such as concrete, brick, and steel), you must select and supply the appropriate hardware yourself.

Note 2: Be careful when tightening the screws—do not crush the ceiling tile. In ceilings that use glass fiber panels, you might need to use a crossbrace above the fiber panel to provide the required rigidity and support.

- 5 Connect the coaxial cables to the antenna by attaching the cable connectors to the appropriate input and output ports on the antenna.

Note: Be careful not to realign the direction of the antenna or knock the antenna off of vertical.

Hidden ceiling mount

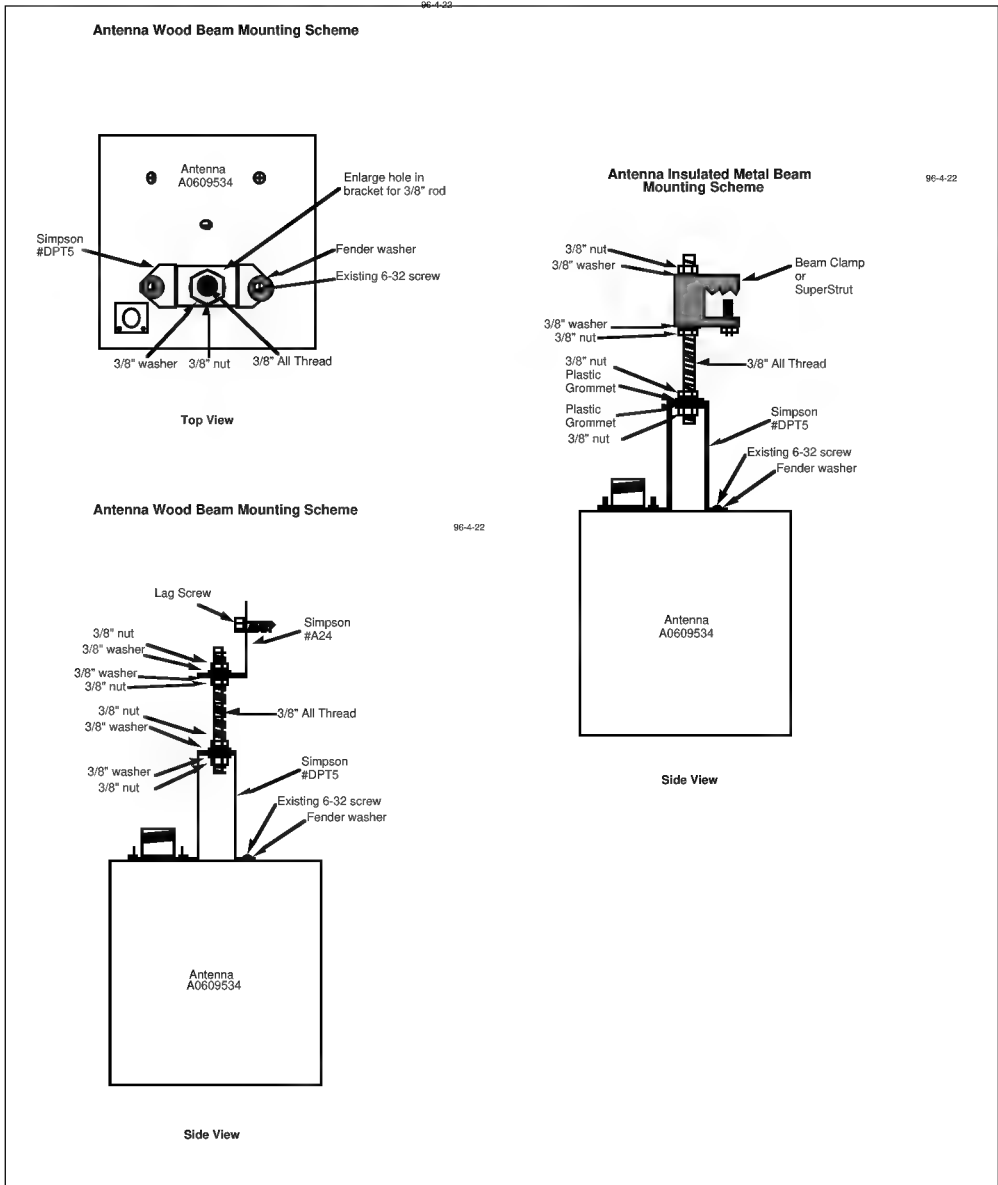
For a hidden ceiling mount, you need the following items:

- Two 2 in. x 1/4 in. bolts
- Two washers (1.75 in. outside diameter, 1/4 in. inner diameter)
- Two 1/4 in. nuts

If the mounting location is an air plenum area, then the antenna should be rated fire retardant.

You can install a hidden ceiling mount on a wood beam or metal beam above the ceiling tiles. Figure 39 shows one method of attachment.

Figure 39
Hidden ceiling mount to wood beam or metal beam



To mount a hidden antenna in a false ceiling, perform the following steps:

- 1 Note the location of the antenna on the floor plans and the direction it is supposed to face.
- 2 Check to see if there are any obstructions. Make adjustments if necessary, but stay within the tolerances stated on the floor plan.
- 3 Remove the ceiling panel next to the one you are working with to gain access to the top of the panel.
- 4 Place the antenna 2 in. to 3 in. (5 cm to 7.5 cm) above the ceiling tile so that you can lift the tile up to rotate the antenna to the right position. Do not place the antenna higher than 3 in. (7.5) centimeters or you will lose coverage.
- 5 Bolt the antenna in place. It is important that the antenna be bolted on tightly enough so that it cannot accidentally move around or rotate.
- 6 Connect the coaxial cables to the antenna by attaching the cable connectors to the appropriate input and output ports on the antenna.

Note: Be careful not to realign the direction of the antenna or knock the antenna off of vertical.

Installing Microcellular Base Stations

This section covers mounting the Microcellular Base Stations and installation of all MBS modules. Before starting the installation, refer to “Preparing for installation” on page 37 for preinstallation tasks.

Preparing for MBS installation

Nortel recommends the following tools to install an MBS:

- Installers tool kit:
 - Level
 - Tape measure
 - Drill
 - Power screwdriver
 - Wrenches
 - Screwdrivers
 - Hammer
 - Digital Volt Meter
 - MDF punch-down tool
- Wrist grounding strap
- Masonry drill
- Hacksaw
- Wet/dry vacuum

Use of a wrist strap is mandatory when handling circuit packs or modules.

CAUTION

When inserting modules into an MBS, use care while applying direct pressure to the module handle. Never slam the module into its slot.

Before unpacking any modules, ensure that you are wearing an antistatic wrist strap. Connect the wrist strap and cord to the grounding point on the front trim panel of the MBS module.

Unpack and inventory all MBS modules to ensure the correct modules have been received. Check all the modules for any signs of damage. If any of the modules are damaged, report this for repair and return.

Customer-supplied equipment

For each MBS, the customer needs to supply a wooden backboard, an AC outlet close to the backboard, frame punch-down blocks, and a permanent ground wire.

For each MBS, the customer should also provide an Uninterrupted Power Supply (UPS) for battery backup during power loss.

If AC power surge is a known issue, Nortel recommends supplemental external AC power surge protection for the MBSs.

Figure 40 and Figure 41 show the front and back of an MBS.

Figure 40
Front view of MBS

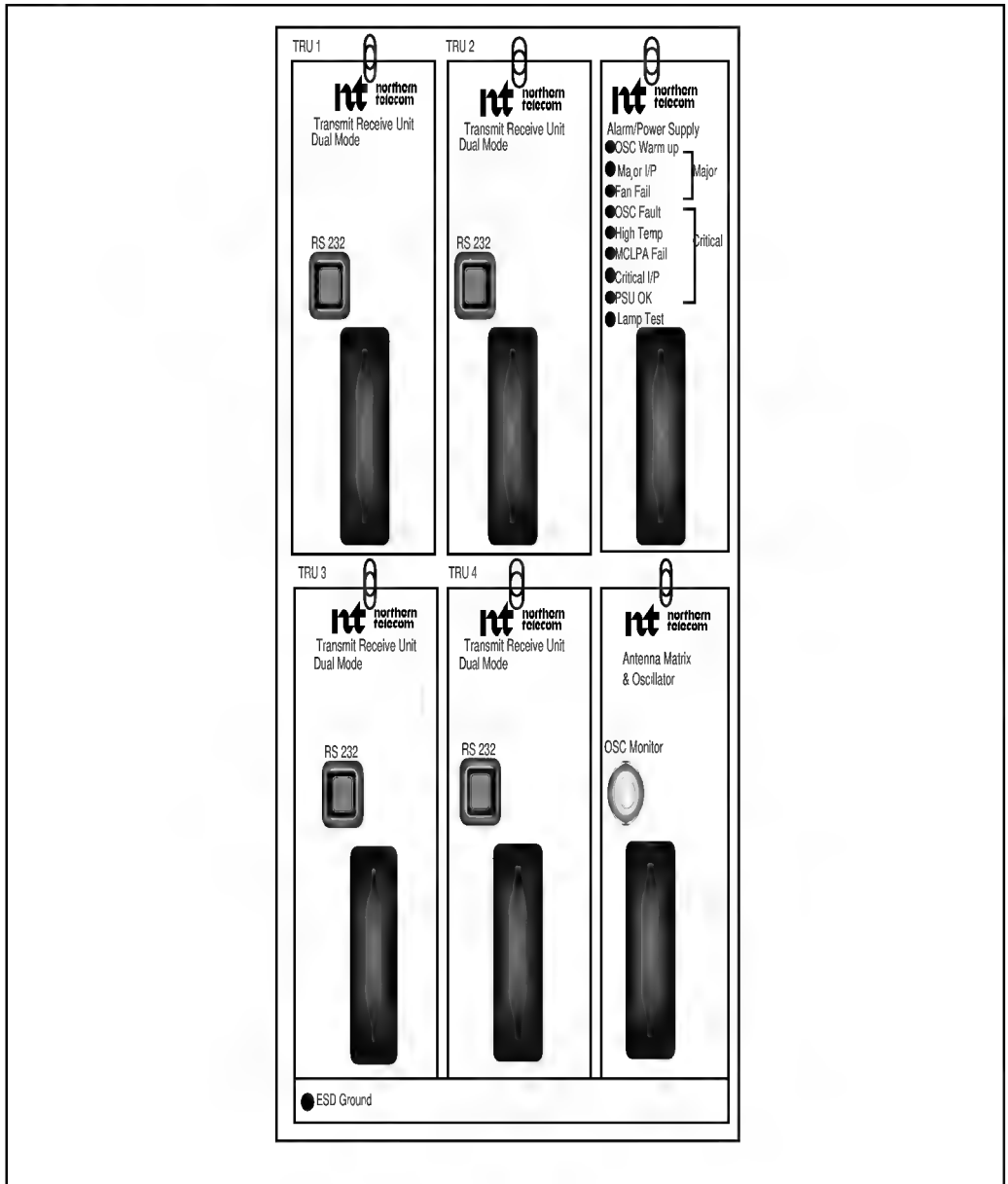
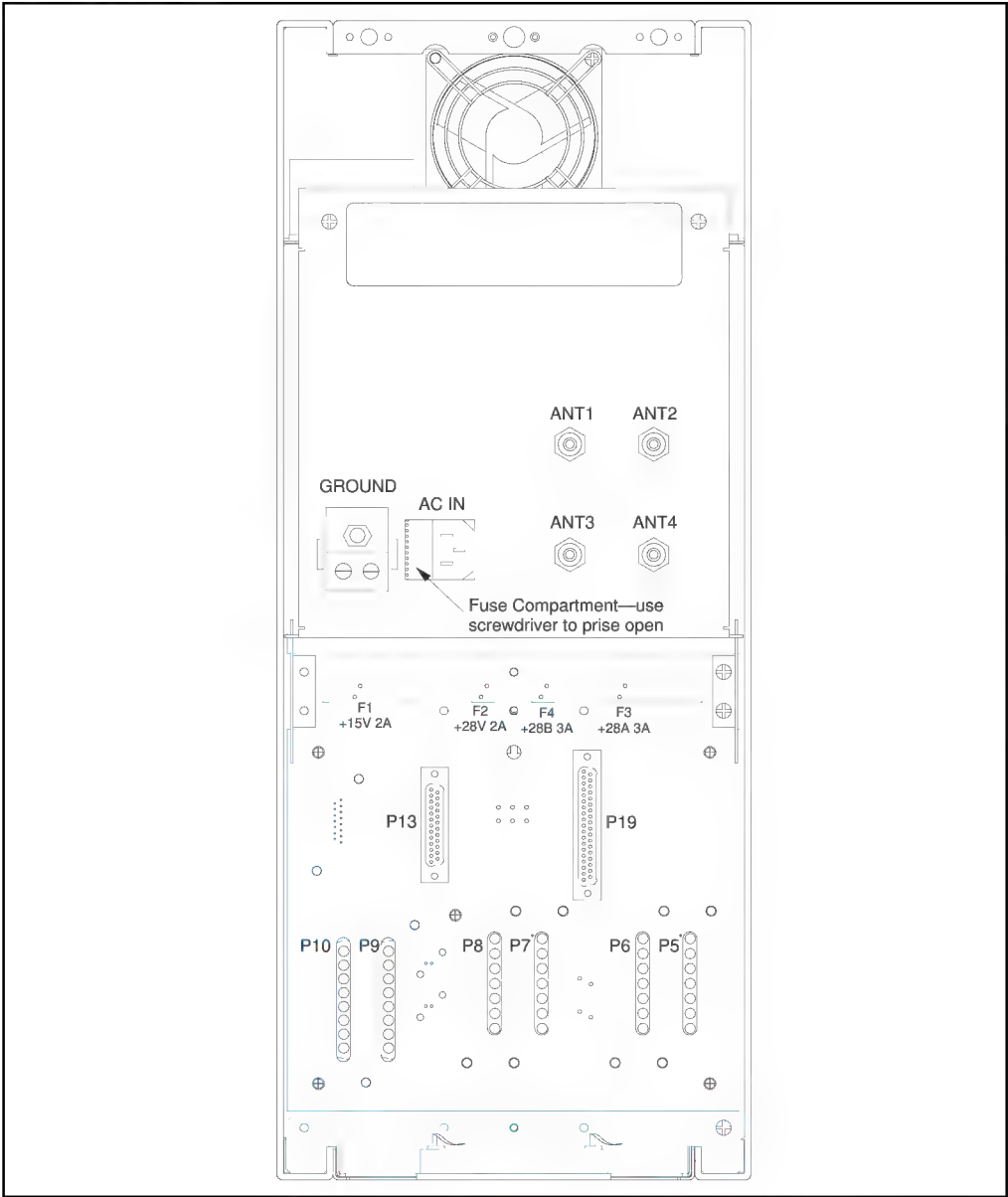


Figure 41
Rear view of MBS



MBS (Microcellular Base Station) environment

Any room where you install Microcellular equipment must be clean and well-ventilated. Each MBS cabinet can dissipate up to 150 watts of power in the form of heat (500 Btu/h). Equipment room ventilation must be sufficient to maintain the temperature at an acceptable level.

The acceptable temperature levels follow:

- 5° to 40° C (41° to 105° F) for continuous operation
- 0° to 50° C (32° to 120° F) for short-term operation

Short term is not more than 72 consecutive hours and a total of not more than 15 days in one year.

The humidity needs to be maintained between 20% and 95% RH (noncondensing) at 40° C worst-case temperature and not to exceed 0.024 lbs of water per pound of dry air for continuous operation.

The MBS functions from an altitude of 200 ft (61 m) below sea level to 13,000 ft (3,962 m) above sea level. The maximum operational temperature requirement is derated by 2° C (3.6° F) per 1,000 ft (305 m) for altitudes above 7,000 ft (2,134 m).

The following restrictions apply to MBS location:

- The power cord for an MBS, which requires local AC power (110/240VAC), is 6.5 ft (1.98 m) long, so the MBS must be approximately 6 ft or less from an AC power outlet.
- The location selected to mount an MBS must not be subject to constant vibration.
- The loop length from the Meridian 1 IPE shelf or slot to an MBS is limited to 3,000 ft (914 m) due to the TRU-II interface.

- An MBS must be at least 12 ft (3.66 m) away from any source of electrostatic or electromagnetic energy, including the following:
 - Power tools
 - Appliances (such as vacuum cleaners)
 - Office business machines (such as copying machines)
 - Electric motors
 - Electrical transformers

An MBS weighs approximately 85 pounds fully configured (including four TRU-IIIs). It is approximately 21 in. (53.34 cm) high, 9 in. (22.86 cm) wide, and 23 in. (58.42 cm) deep.

The total floor loading for the MBS is as follows:

- Using the floor mount kit, total floor loading is 37 lbs/sq ft (1.8 KN/Msq).
- Using the 19 in. (48.26 cm) rack-mount kit, total floor loading is 29.2 lbs/sq ft (1.4 KN/Msq), based on the following assumptions:
 - 19 in. (48.26 cm) rack weighing 60 lbs
 - 2 MBSs in the rack
 - Aisle width of 3 ft (91.44 cm) front and 2 ft (60.96 cm) rear
 - Aisle depth of 2 ft (60.96 cm)

Mounting the MBSs

This subsection describes floor, rack, and wall mounting for installation of Microcellular Base Stations.

MBS earthquake floor mounting

To install an MBS with an earthquake floor mount, do the following:

- 1 Locate the floor-mount bracket and the anchors provided.
- 2 Determine the desired location of the floor-mount bracket.

- 3 Make sure that you leave enough room behind the MBS for installation and maintenance access. Also take into consideration the location of the hybrid or hybrids (if required in the configuration). The MBS(s) and hybrid(s) need to reside close together because the MBS-to-hybrid cables are only 6 ft (1.83 m) long.
- 4 Attach the MBS to the floor mount brackets at the mounting holes, using the 4 flat washers and 4 locking nuts provided.
- 5 Once the brackets are attached to the MBS, the MBS can then be used to mark the floor for drilling the holes.
- 6 Secure the MBS to the floor using the anchors provided. Do not tighten all the way because the MBS will need to be leveled prior to tightening.
- 7 Using a small level, check the MBS to see if it is level. If the MBS is not level, use the shims provided with the kit to level the MBS. You should level the MBS from front to back and then from side to side.
- 8 Once the MBS is level, tighten the anchors to the floor. Check the MBS again to make sure it is still level.
- 9 Apply the brand liners to the exterior sides of the MBS.

MBS standard floor mounting

To install an MBS with a standard floor mount, do the following:

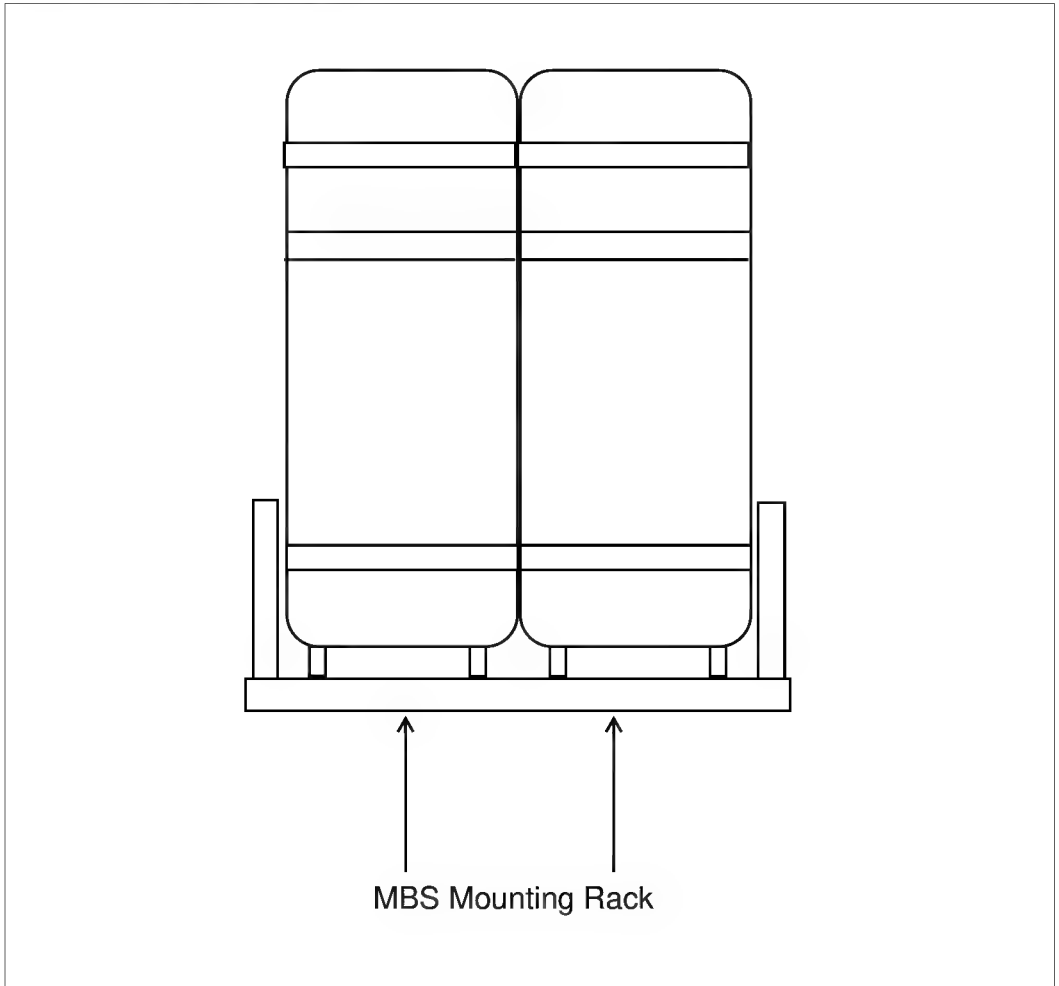
- 1 Locate the floor mounting bracket and the anchors provided.
- 2 Determine the desired location of the floor mount bracket.
- 3 Make sure that there is enough room left behind the MBS so that it can be accessed for installation and maintenance. Also take into consideration the location of the hybrid or hybrids (if required in the configuration). The MBS(s) and hybrid(s) need to reside close together because the MBS-to-hybrid cables are only 6 ft (1.83 m) long.
- 4 Place the black plastic fillers in the four holes in the legs.
- 5 Apply the brand liners to the exteriors sides of the MBS.

MBS rack mounting

To install an MBS with a rack mount, do the following:

- 1** Locate the rack mounting bracket and the screws provided.
- 2** Make sure that there is enough room left behind the MBS so that it can be accessed for installation and maintenance. Also take into consideration the location of the hybrid or hybrids (if required in the configuration). The MBS(s) and hybrid(s) need to reside close together because the MBS-to-hybrid cables are only 6 ft (1.83 m) long.
- 3** Install the rear support bar to the back of the rack using the 4 screws provided. See Figure 42 for a rack mount illustration.
- 4** Install four standoffs on the front of the tray and four standoffs on the back of the tray if this is not already done.
- 5** Install the tray by sliding it on top of the rear support bar from the front of the rack so that the rear support bar is holding the back end of the tray.
- 6** With the 8 screws provided, secure the tray to the rack.
- 7** Lift the empty MBS into the tray, aligning the feet holes with the standoffs. Secure the MBS to the standoffs with the flat washers and locking nuts provided.
- 8** The second, optional MBS might require a second person to help position it into place because the MBSs are very close together in the tray.
- 9** Lift the second MBS into the tray, aligning the feet holes with the standoffs and securing it to the standoffs with the flat washers and locking nuts provided. At this point you can check the unit to see if it is level. If the unit is severely unlevel, you need to check the rack to ensure that it is level, since there are no adjustment points on the MBS itself. If an already established rack is severely unlevel, contact the job supervisor to get a resolution.
- 10** Apply the brand liners to the exterior sides of the MBS or MBSs.

Figure 42
Rack-mounted MBSs, front view



Installing a backboard

All wall-mounted equipment must be mounted to a 3/4 inch (19mm) sheet of plywood on the wall.

Note: When installing plywood, be sure to adhere to all fire codes. Many state and local codes require the use of fire-retardant wood for telephone back boards.

If the site does not have this backboard already in place, do the following to install it:

1 Determine the size of the backboard.

You will need a backboard that is large enough to accommodate all of your wall-mounted components and to support your equipment. When determining the required size, make sure it is within the following limits:

- Maximum Backboard Size: 4 ft by 8 ft (122 cm by 244 cm)

2 Determine the fastener requirements.

The horizontal distance between fasteners for wood and metal stud walls is determined by the spacing between wall studs, which must be within the following ranges:

- Minimum allowed stud spacing: 16 in. (40.64 cm)
- Maximum allowed stud spacing: 24 in. (60.96 cm)

The studs need to be supported at both the top and bottom of the wall to prevent buckling or possible collapse.

3 Determine the placement of the fasteners.

Table 7
Hardware recommendations for backboard fasteners

Type of Wall	Fastener	Vertical spacing between fasteners	Minimum embedment
Wood stud	#10 wood screws	12 in. (30.48 cm) on center	1 in. (2.54 cm)
Metal Stud	#14 sheet metal screws	12 in. (30.48 cm) on center	1 in. (2.54 cm)
Concrete	1/4 in. Hilti KB-II or equivalent	24 in. (60.96 cm) on center	1-1/4 in. (2.86 cm)
Masonry	1/4 in. Ramset Redhead Dynabolt Sleeve Anchor or equivalent	24 in. (60.96 cm) on center	1-1/4 in. (2.86 cm)

Table 8
Maximum wall height and stud sizes, 16-inch spacing

Wall studs	Maximum height of wall
Wooden studs	
2 X 4 (DF #2)	11 ft (3.35 m)
2 X 6 (DF #2)	19 ft (5.79 m)
Metal studs	
2 1/2 X 20 gauge	9 ft (2.74 m)
2 1/2 X 16 gauge	10 ft (3.05 m)
2 1/2 X 14 gauge	11 ft (3.35 m)
3 5/8 X 20 gauge	12 ft (3.66 m)
3 5/8 X 18 gauge	13 ft (3.96 m)
3 5/8 X 16 gauge	14 ft (4.27 m)
3 5/8 X 14 gauge	16 ft (4.88 m)
4 X 20 gauge	14 ft (4.27 m)
4 X 18 gauge	15 ft (4.57 m)
4 X 16 gauge	16 ft (4.88 m)
4 X 14 gauge	17 ft (5.18 m)
6 X 18 gauge	20 ft (6.1 m)

Table 9
Maximum wall height and stud sizes, 24-inch spacing

Wall studs	Maximum height of wall
Wooden studs	
2 X 4 (DF #2)	10 ft (3.05 m)
2 X 6 (DF #2)	17 ft (5.18 m)
Metal studs	
2 1/2 X 20 gauge	8 ft (2.44 m)
2 1/2 X 18 gauge	9 ft (2.74 m)
2 1/2 X 14 gauge	10 ft (3.05 m)
3 5/8 X 20 gauge	11 ft (3.35 m)
3 5/8 X 18 gauge	12 ft (3.66 m)
3 5/8 X 16 gauge	13 ft (3.96 m)
3 5/8 X 14 gauge	15 ft (4.57 m)
4 X 20 gauge	12 ft (3.66 m)
4 X 18 gauge	13 ft (3.96 m)
4 X 16 gauge	14 ft (4.27 m)
4 X 14 gauge	16 ft (4.88 m)
6 X 18 gauge	18 ft (5.49 m)

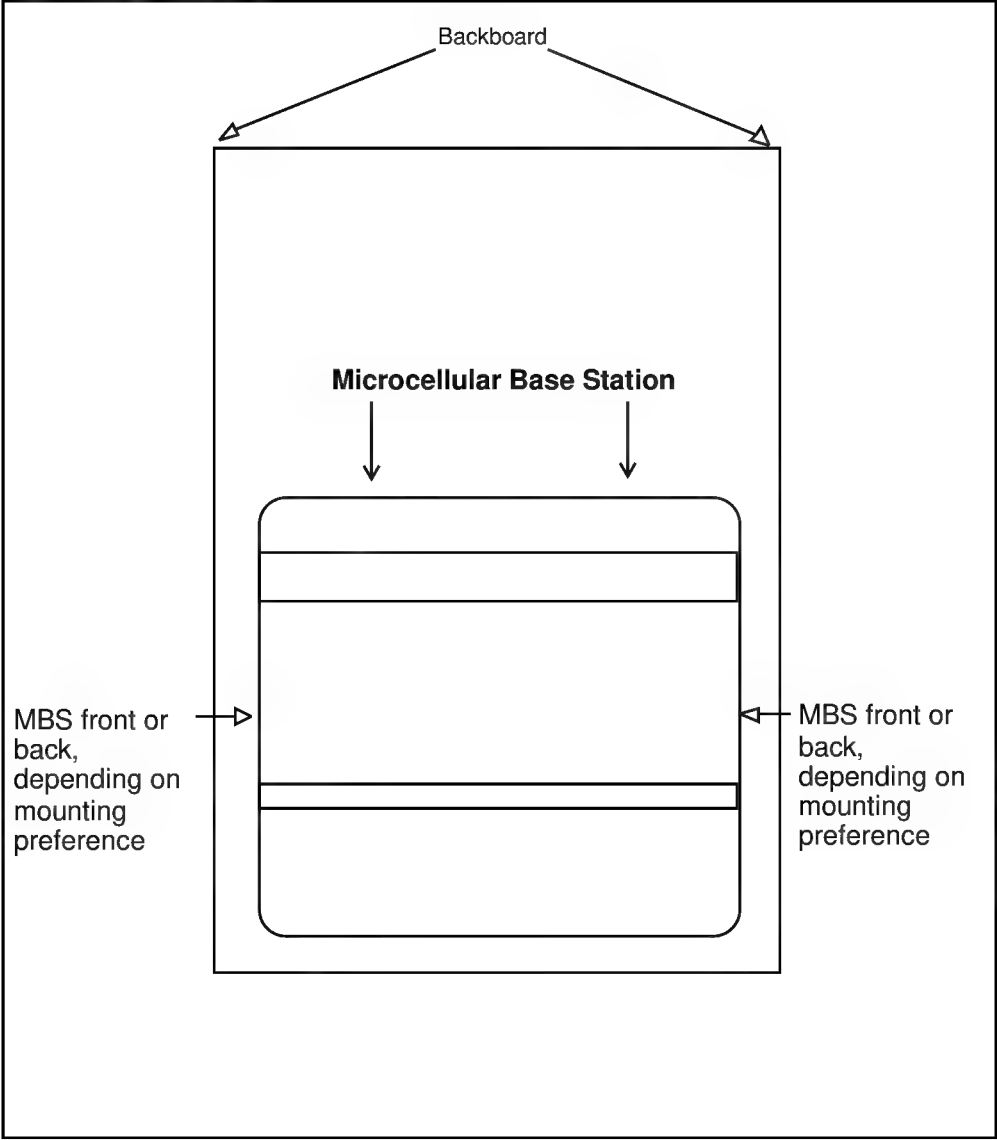
MBS wall mounting

Figure 43 illustrates MBS wall mounting. To install an MBS with a wall mount, do the following:

- 1 Locate the wall mounting bracket and the screws provided.
- 2 Determine the desired direction of the wall mount bracket pivoting.
- 3 If the pivot direction agrees with the supplied configuration of the wall bracket assembly, continue with step 8.
- 4 If the pivot direction does not agree with the supplied configuration of the wall bracket assembly, continue with step 5.
- 5 Locate and remove the 4 machine screws in the upper stiffener plate and the 2 machine screws in the lower stiffener plate. At this point you will need to slide the locking bar past the locking position by holding up the locking pin and remove the locking bar through the large access slot.
- 6 Reverse the position of the upper and lower stiffener plates (place the lower stiffener plate on the crossmember where the upper stiffener plate was, and vice versa).
- 7 Resecure the upper and the lower stiffener plates with the machine screws removed in step 5. Resecure the locking bar onto the slider plate on the side where the new lower stiffener has been installed. If the bar does not slide properly, trim the bar with a hacksaw.
- 8 Release the pivot arm to enable the bracket to swing open fully. This will make installing the bracket to the wall easier. This will require two people.
- 9 Place the wall mount bracket on the plywood backboard where it is to be fastened. Secure one of the top corners of the MBS bracket with one of the wood screws provided.
- 10 While holding the other end of the MBS bracket, place a small level along the top of the MBS bracket, making sure it is level. Install another wood screw into the corner that has not been secured yet.
- 11 After both top corners have been fastened to the wall, check to make sure the wall mounting bracket is still level before installing the additional 20 wood screws.
- 12 Install the 20 remaining wood screws into the wall mount bracket.

- 13** Ensure that the locking bar is correctly positioned in the slider tab and locked into the closed position.
- 14** Insert the three shoulder screws provided into the threaded side holes of the empty MBS, on the correct side for the pivot direction chosen.
- 15** Lift the empty MBS and align the shoulder screws with the locating notches in the upper stiffening plate of the wall bracket assembly. (It is recommended that two people lift and secure the MBS.) Lower the MBS into place until the chassis is supported by the lower stiffening plate. At this point you can recheck the unit to see if it is still level. If the unit is not level, remove the MBS from the bracket and recheck the bracket to ensure that it is level, since there are no adjustment points on the MBS itself.
- 16** Insert the 2 machine screws through the lower stiffening plate into the threaded inserts in the base of the MBS and tighten them.
- 17** Apply the brand liner to the exposed exterior side of the MBS.
- 18** When complete, swing the wall bracket into the wall and ensure that the latch is in place.

Figure 43
Wall mount side view



Installing power and ground cables

When you install power and ground cables, you need to take certain safety precautions. You also need to meet commercial power requirements for MBS power and verify the power to each MBS.

Precautions

Use of a wrist strap is mandatory when handling circuit packs and when wiring to a backplane.

Installer(s) should not wear jewelry, watches, or any other metal objects.

Well-insulated tools are a **MUST** while working on or around powered equipment.

The MBS modules should be inserted into the MBS prior to power-up.

When inserting modules, ensure that MBS modules are inserted using the locklatches rather than the center of the faceplate.

Power and grounding of the MBS

To install the power and grounding for an MBS, do the following:

- 1** Locate the power cord NTLA0010 and plug it into J1 on the back of the MBS.
- 2** Cut a piece of power cable (#6 through #14 AWG wire is acceptable) long enough to reach from the ground (J2) position on the back of the MBS, to the site ground location.
- 3** Remove a small piece (1/4 inch) of the insulation from the cable and insert it into the ground position (J2) on the back of the MBS.
- 4** Run and dress the ground cable to the designated site ground location.
Note: If you install MBSs next to each other, you can make a single connection to the site ground location and then daisy chain the ground between MBSs.
- 5** Run the power cord to the closest dedicated AC outlet provided by the customer. Do not attach the power cord to other cables or to the backboard.

MBS commercial power requirements

The Microcellular Base Station is available for AC power only. It requires one nonswitched, dedicated power outlet per MBS cabinet, convenient to the back of the MBS. The power cord is 6.5 ft (1.98 m) in length.

Each outlet must have the following:

Voltage	115 VAC $\pm$ 15% or 230 VAC $\pm$ 15%
Frequency	47 Hz to 63 Hz
Power (I/P max)	300 VA
Receptacles	120 V 15 A service NEMA IG 5-15R -208/240 V 15 A service IG 6 15R

If AC power surge is a known issue, Nortel recommends supplemental external AC power surge protection for the MBSs.

For each MBS, the customer should also provide an Uninterrupted Power Supply (UPS) for battery backup during power loss.

The customer must supply lightning surge protectors for any outside antennas.

A permanent ground connection must be made from the MBS to an AC ground point (such as the AC panel, conduit, or green wire ground) using #6-#14 AWG wire.

Note: An equipment grounding conductor that is not smaller in size than the ungrounded branch-circuit supply conductors is to be installed as part of the circuit that supplies the product. Bare, covered, or insulated grounding conductors are acceptable. Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green or green with one or more yellow stripes. The equipment grounding conductor is to be connected to ground at the service equipment.

The attachment-plug receptacles in the vicinity of the product are all to be of a grounding type, and the equipment grounding conductors serving these receptacles are to be connected to earth ground at the service equipment.

WARNING

The socket-outlet shall be installed near the equipment and shall be easily accessible. Do not fasten the power supply cord to any building surface, including the backboard.

Power verification of the MBS

When you use a multimeter to check for shorts on power cables or buses, set the digital multimeter to the 200 ohm range and ensure that cables are not powered up. When checking the voltages, set the multimeter to the appropriate type of current, AC or DC, and select a voltage range slightly higher than the voltage you are measuring. Always connect the black probe of the multimeter to the ground (neutral) terminal and the red probe to the battery (hot) terminal.

Step	Action	Observation
1	Remove all AC power cords from outlets if they have already been installed.	
2	Using the Digital Multimeter, check all dedicated outlets for proper power and grounds	Should be reading the standard voltage for the country in which the equipment is being installed (see the preceding page). Warning: Ensure that a proper ground is present at all dedicated AC outlets.
3	Verify that the dedicated ground has no other potentials present and the ground is good before powering up the MBS.	There should be no potential between the dedicated ground and the AC ground.
4	Plug the MBS power cord into one of the verified AC outlets.	
5	Since no power on/off switches are on the MBS, when plugging the power cord into the back, observe the PSU_OK indicator on the Alarm/Power Supply Module.	This light should be illuminated.
6	The fuses on the MBS backplane can be measured for proper potential if necessary.	Multimeter reading of fuses on MBS backplane: 28 V A&B 15 V AMO power up 12 V CSMO internal voltage 12 V Fan (11 V - 13 V)
7	Repeat steps 1 through 6 for each MBS.	

Connecting MBSs to hybrids and antennas

To connect MBSs to hybrids or to the coaxial cables that run from antennas, do the following:

- 1 Attach the cables from each MBS to the hybrid input ports or to the coaxial cable connectors, as indicated in the site planning connectivity chart.
- 2 Terminate each unused MBS output port that does not connect to an antenna or hybrid with a TNC 50-ohm terminator (part number: Nortel NTLA0002, Huber & Suhner 65TNC-50-0-1/133, or Rosenberger 56S155-010A4).
- 3 Terminate every unused input port of each active hybrid section with a 50-ohm 1-watt terminators (part number: Nortel A0609689, Andrew 50T-007, MA-COM 3001-6113-00, Radiall, Inc. R404-130, or Huber & Suhner AG 65N-50-0-11/122).

Cross-connecting MBSs to a Meridian 1 system

To install the MBS interface cable (NTLA0020), do the following:

- 1 Make sure the cable has tags on both ends describing where the cable originates and ends.
- 2 Attach the cable's 25-pin Dsub connector to position P13 on the back of the MBS.
- 3 Depending on where and how the MBS is mounted, run and dress the cable to the distribution frame (DF).
- 4 Punch down the cable to the distribution-frame block. For cable pin out information, see Table 10. Punch down *only* the four TCM pairs.
- 5 Make sure to label the blocks with information about what they are connected to. This will ease troubleshooting in the future.

Note: The MBS interface cable is provisioned with an AMP connector on the MDF side. If the block is not compatible, cut off the connector and punch down the wire pairs directly.

To cross-connect an MBS to a Meridian 1 system, do the following:

- 1** Locate the AMP connector end of the cable to be cross-connected.
- 2** Refer to Table 10 to determine what signals are on each AMP pin.
- 3** Use a Digital Multimeter on each AMP pin to confirm the signal location on the block. The Multimeter yields a tone when the correct DF position is found.
- 4** Log the DF pin number onto the blank DF Position column beside the corresponding signal.
- 5** Review Table 10 to determine the signals that need to be cross-connected together.
- 6** Wire the Meridian 1 block pin number to the MBS block pin number.
- 7** Repeat steps 1 through 6 for each signal on all cables.

Note: If the AMP connectors are not compatible with existing customer equipment, cut them off and punch down directly to the blocks.

Table 10
Suggested MBS TCM and Meridian 1 MXC port connections

MBS connector (P13, back of MBS) pin number	Color code*	Signal	Amp connector side P1	DF pin number	Meridian 1 MXC Port connection
* Your cable color codes might differ. If you cut off the connector, you can use the colors on the connector as a reference.					
MBS 1					
22	R/B	TCM 0 Tip	47		1
10	B/R	TCM 0 Ring	22		26
23	R/O	TCM 1 Tip	48		2
11	O/R	TCM 1 Ring	23		27
24	R/G	TCM 2 Tip	49		3
12	G/R	TCM 2 Ring	24		28
25	R/Br	TCM 3 Tip	50		4
13	Br/R	TCM 3 Ring	25		29
MBS 2					
22	R/B	TCM 4 Tip	47		5
10	B/R	TCM 4 Ring	22		30
23	R/O	TCM 5 Tip	48		6
11	O/R	TCM 5 Ring	23		31
24	R/G	TCM 6 Tip	49		7
12	G/R	TCM 6 Ring	24		32
25	R/Br	TCM 7 Tip	50		8
13	Br/R	TCM 7 Ring	25		33

Installing the Alarm and Power Supply (APS) module

The Alarm and Power Supply (APS) module collects various local and optional remote MBS alarms, which Table 11 lists.

Table 11
Alarms sent to Alarm and Power Supply module

Alarm	Critical	Major
High temperature	X	
PSU fault	X	
MLCPA failure alarm	X	
CSMO oven fault	X	
External critical alarm	X	
CSMO warm-up		X
CSMO output fault		X
External major alarm		X
Fan fault		X

TRU-II #1 routes the critical alarms to the Microcellular system as PA alarms, and TRU-II #2 routes the major alarms to the system as PA alarms. Note that if only one TRU-II is equipped in an MBS in a cell (in the second, third, or fourth MBS in the cell), the MBS reports only critical alarms to the Microcellular system, through TRU-II #1.

Configuring the APS module

You need to configure the APS module before you insert it into the MBS slot. The APS has four slide switches and one four-pole DIP switch located on the bottom, toward the front module. S1 is the forward-most switch (closest to the handle). S5 has four slide switches, identified, starting from the one closest to the front of the module, as S5-1, S5-2, S5-3, and S5-4. Figure 44 shows the location of the switches.

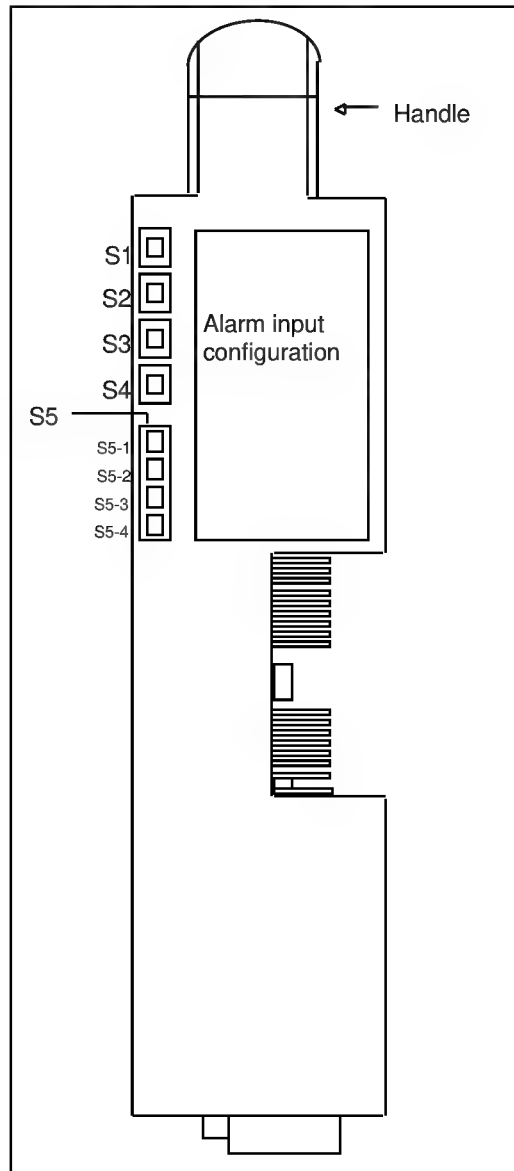
S1, S2, and S3 are slide switches for configuring the alarm inputs for passive (contact closure) alarms or for active (powered) alarms. To configure one of these switches for passive alarms, slide it toward the back end of the module. To configure a switch for active alarms, slide it toward the front end of the module. These switches control the following alarm inputs:

- S1 Critical Alarm Input
- S2 Major Alarm Input
- S3 MCLPA Failure Alarm Input

S4 is a slide switch for configuring public or private mode. For the Microcellular system, slide the switch toward the front end of the module for private mode.

S5 determines whether the input alarms will be active with loop current flowing or active with no loop current flowing. For the Microcellular system, set all the S5 switches down, for loop current flowing.

Figure 44
Configuration switches on bottom of APS module



Installing the configured APS

To install the configured APS into an MBS, do the following:

- 1** Slide the APS module into the slot provided, making sure that the module is properly seated. Handle the APS with two hands, one on the handle and one supporting the base of the module (due to weight). Position the guide rib of the module into the card guide in the MBS and slide the module in slowly until the connectors make contact. Then apply firm force to mate the connectors securely. Refer to Figure 40 for a picture of the MBS fully provisioned.
- 2** With a flat-head screwdriver, secure each module by tightening the locking tab at the top of each of the slots.

Installing the Antenna Matrix/Oscillator (AMO)

To install the AMO (NTLA30AA) into an MBS, do the following:

- 1** Slide the AMO module into the slot provided, making sure that the module is properly seated. Handle the AMO with two hands, one on the handle and one supporting the base of the module (due to weight). Position the guide rib of the module into the card guide in the MBS and slide the module in slowly until the connectors make contact. Then apply firm force to mate the connectors securely. Refer to Figure 40 for a picture of the MBS fully provisioned.
- 2** With a flat-head screwdriver, secure each module by tightening the locking tab at the top of each of the slots.

Installing radio modules

To install from 1 to 4 TRU-IIs (NTAX98AA) into an MBS, do the following:

- 1 Slide each TRU-II module into the slot provided, making sure that the module is properly seated. Handle the TRU-II with two hands, one on the handle and one supporting the base of the module (due to weight). Position the guide rib of the module into the card guide in the MBS and slide the module in slowly until the connectors make contact. Then apply firm force to mate the connectors securely. Refer to Figure 40 on page 107 for a picture of the MBS fully provisioned.
- 2 After the system has been commissioned, secure each module with a flathead screwdriver by tightening the locking tab at the top of each of the slots.

Note: The TRU-IIs are always populated sequentially beginning with TRU-II slot #1.

Installing MBS covers

The MBS plastic covers need to remain off during cabling and while the units are being powered up. To install the covers on an MBS after it is powered up, do the following:

- 1 Locate the plastic covers for the front and the back of the MBS.
- 2 Place the lower catches or mounting tabs of one cover into the lower corner of the MBS with the top of the panel tilted slightly away.
- 3 Snap the cover into place on the ball studs at the top of the cover.
- 4 Lock the cover into place by turning the 1/4-turn fastener at the top center of the cover using a flathead screw driver. To remove the cover, the captive 1/4-turn fastener must first be released, then gently pull the cover away from the unit while holding onto the depression in the top of the cover.
- 5 Follow steps 2 through 4 for the other cover.

Installing Automatic Frequency Planning (AFP) Stations

This section covers the installation of AFP Stations with TCM or serial connections to a local MSM MAT.

TCM connections require the installation of a Meridian Communications Unit (MCU) connected to the MSM MAT. The MCU and the AFP Stations connect to DLC ports on the Meridian 1 system through TCM cable. The MCU enables the Mobility System Management AFP software on the local MAT to access each AFP station as if it were a Meridian 1 phone set.

Serial connections require a short-haul modem for each AFP Station, a corresponding short-haul modem at a serial port on the MSM MAT, and telephone cable to connect the modems.

Preparing for installation

You need the following equipment and supplies for installing AFP Stations:

- Marked-up floor plans that indicate the location of each AFP Station at the Microcellular site as well as the locations of the Meridian 1 system and Microcellular antennas.
- The AFP Station or Stations

The site planning documents should specify the number of AFP Stations to use for the Microcellular site, based on the following guidelines:

- A Microcellular system can have up to 12 AFP Stations (Option 11C, 51C, 61C, 81, or 81C)
- Each AFPS can cover approximately 100,000 sq ft of floor space, based on the length and width of the building and calculating for only one story.

- If you are using TCM connections for the AFP Station or Stations, the following items:
 - Power supply for the AFPS, either a plug-top power supply or a Remote Power Interconnect (RPI) unit. For mounting the RPI, you need two number 8 round head, 2 in. (50 mm) screws. For connecting the RPI to each AFPS, you need TCM cable.
 - One Meridian Communications Unit (MCU)
 - TCM cable to connect the MCU to a DLC port and to connect each AFP Station to a DLC port (up to 3,000 ft for each connection)
 - RS-232 modem pool cable to connect the MCU to the local MSM MAT
 - Screwdriver

A separate DLC port must be available on the Meridian 1 system for each AFP Station and for the MCU.

- If you are using serial connections for the AFP Station or Stations, the following items:
 - Power supply for the AFPS, either a plug-top power supply or a Remote Power Interconnect (RPI) unit. For mounting the RPI, you need two number 8 round head, 2 in. (50 mm) screws. For connecting the RPI to each AFPS, you need TCM cable.
 - Two short-haul modems for each AFP Station
 - An RS-232 modem pool cable for each modem, to connect one modem to the MSM MAT and the other to the AFP Station
 - Telephone cable to connect the two modems

A serial port must be available on the MSM MAT for each AFP Station.

Mounting AFP Stations

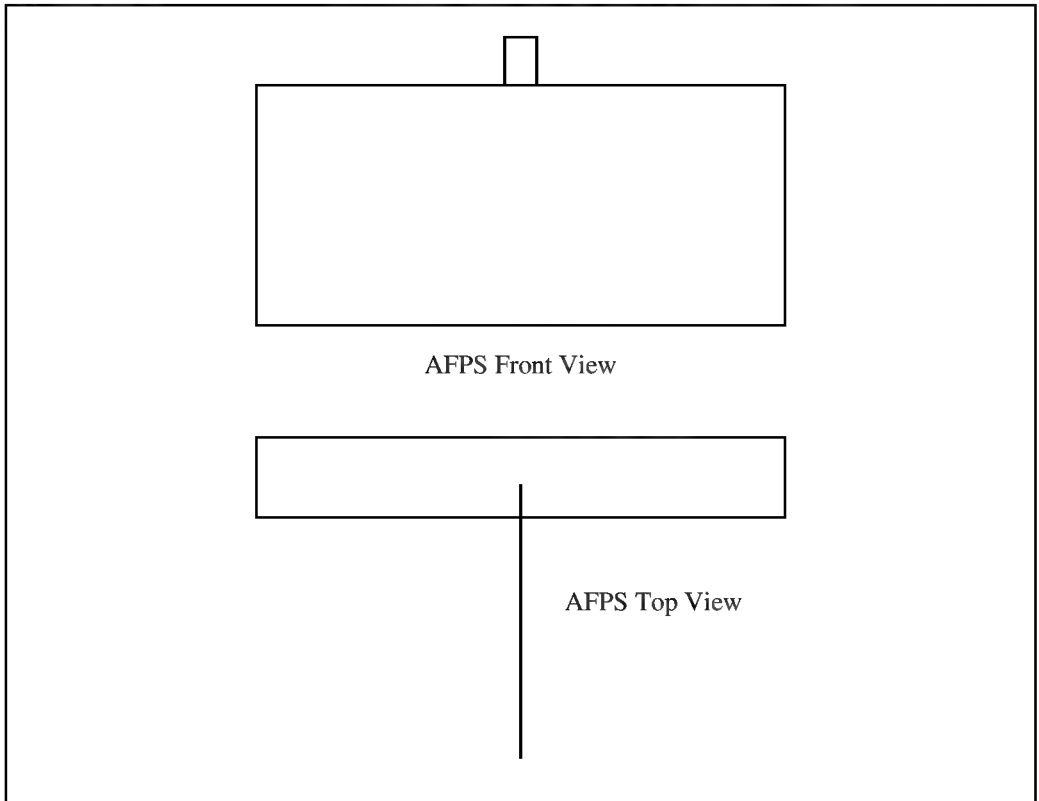
The following guidelines apply to mounting the AFP Stations:

- Place AFP Stations at the highest points of the Microcellular site, but not higher than the 10th floor. For example, for a four-story building, place the AFP Stations in the ceiling of the 4th floor.
- Place multiple AFP Stations as far from each other as possible.

- Do not place an AFPS within 30 feet of a Microcellular antenna or near metal.
- Do not place an AFPS in an air plenum area of the ceiling.
- Do not place an AFPS more than 3,000 feet from the Meridian 1 system if you are using a TCM connection between the AFPS and the MSM MAT because the AFPS cannot be more than 3,000 feet from its DLC port. With a serial connection between an AFPS and the MSM MAT, the AFPS can be farther away from the Meridian 1 system.

Figure 45 illustrates an AFP Station. You need to mount the station vertically, with the antenna perpendicular from the wall.

Figure 45
AFP Station



You can mount an AFP Station on a ceiling or wall. Do not mount the AFP Station near metal. The best place to mount each AFP station is on the ceiling of the top floor of the Microcellular site, but not above the 10th floor.

For mounting each AFP Station, you need two 3/4 in. #10 wood screws.

To mount an AFP Station to a ceiling or wall, perform the following steps:

- 1 Note the location of the AFP Station on the floor plans and the direction that it is supposed to face.
- 2 Check to see if there are any obstructions, such as metal. Make adjustments if necessary, but stay within the tolerances stated on the floor plan.
- 3 Mark the screw holes for the AFP Station on the ceiling or wall.
- 4 Predrill the holes if necessary, then screw the AFP Station in place. You might need to use washers. It is important that the station be screwed on tightly enough so that it cannot accidentally move around.

Note 1: For surfaces that do not accept wood screws (such as concrete or brick), you must select and supply the appropriate hardware yourself.

Note 2: Be careful when tightening the screws—do not crush ceiling tile. In ceilings that use glass fiber panels, you might need to use a crossbrace above the fiber panel to provide the required rigidity and support.

Note 3: Be careful not to realign the direction of the AFP Station or knock it off of vertical.

WARNING

Do not mount an AFP Station in an air plenum area because the AFP Station is not fire rated.

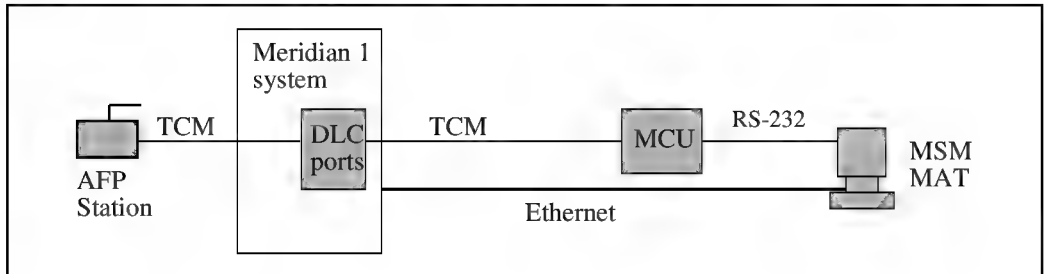
Connecting AFP Stations to the MSM MAT

You can use either TCM connections or serial connections between the AFP Stations and the local MSM MAT. TCM cabling might be more cost-effective. If you need to place an AFP Station more than 3,000 ft. from the IPE shelf, however, a serial connection provides extra distance.

For TCM connections, you need to run TCM cable from each AFP Station to a DLC port on the Meridian 1 system. You also need to run a TCM cable from

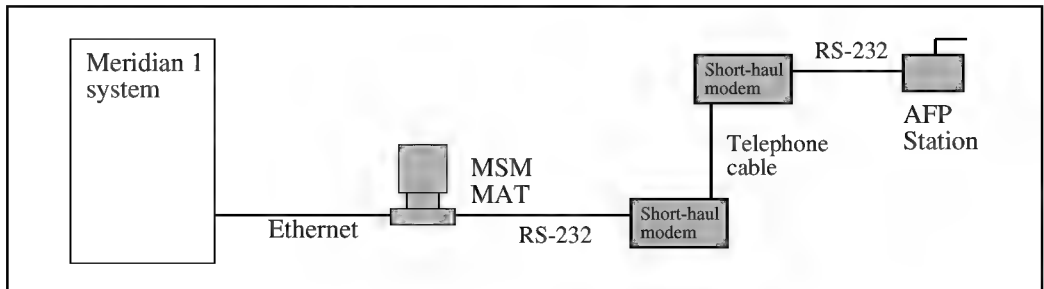
the Meridian 1 system to a Meridian Communications Unit, which connects to the MSM MAT through an RS-232 modem pool cable. Figure 46 illustrates a TCM connection.

Figure 46
TCM connection between AFP Station and MSM MAT



For serial connections, you need a pair of short-haul modems, two RS-232 modem pool cables, and telephone cable for each AFP Station. One modem connects to the AFP Station, and one connects to the MSM MAT, each through an RS-232 cable. The telephone cable runs between the modems. Figure 47 illustrates a serial connection.

Figure 47
Serial connection between AFP Station and MSM MAT



Installing a Meridian Communications Unit (MCU)

An MCU connects to a DLC port on the Meridian 1 system through a TCM cable. The MCU connects to the local MAT, which runs the Mobility System Management program with the AFP feature, through an RS-232 modem pool cable. You need to install the MCU within 3,000 ft of the DLC port and close enough to the MSM MAT for the modem pool cable to reach.

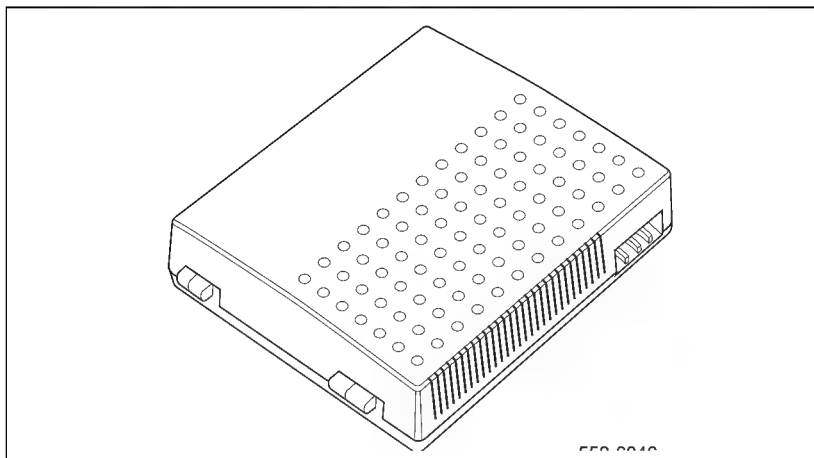
To provide power for the MCU, you need to use a local AC outlet.

Installing a Remote Power Interconnect unit for an AFPS

A Remote Power Interconnect (RPI) unit has a connection board and one or two Power Supply Units (PSUs). The RPI8 has one PSU, and the RPI16 has two PSUs.

Always install an RPI unit inside a building, in a location where its outputs are not exposed. The AC outlet that powers the RPI must be within 15 ft of it.

Figure 48
Remote Power Interconnect unit

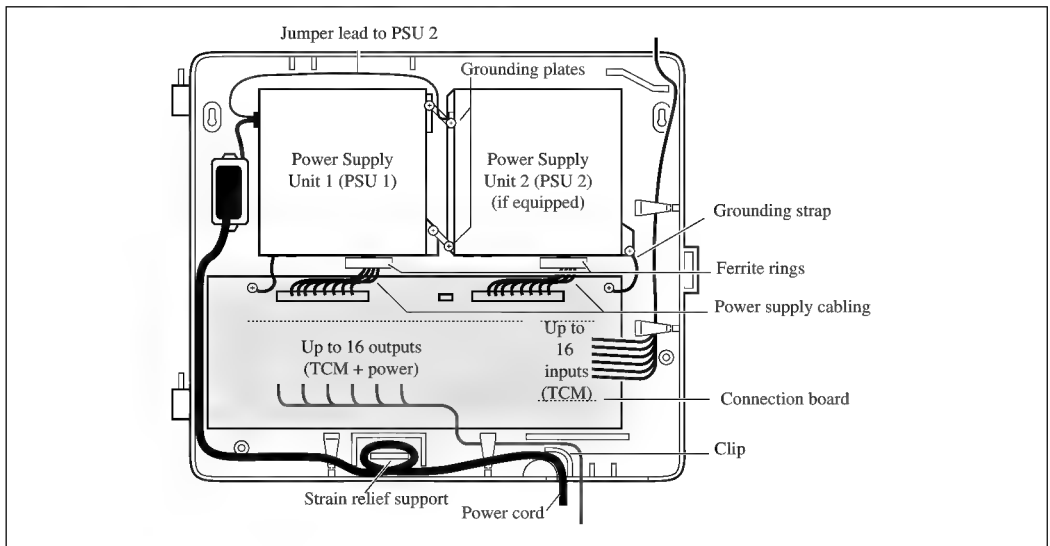


To install a Remote Power Interconnect unit:

- 1 Mount the RPI as described in “Mounting an RPI unit” on page 140.
- 2 Wire the RPI as described in “Wiring an RPI unit” on page 145.

CAUTION
Do not power the RPI until installation is complete.

Figure 49
Remote Power Interconnect components



- 3 If Microcellular system uses Uninterrupted Power Supply (UPS) for MBSs, then make sure that the RPI uses UPS.
- 4 If AC power surge is a known issue, Nortel recommends supplemental external AC power surge protection for the RPI.

Mounting an RPI unit

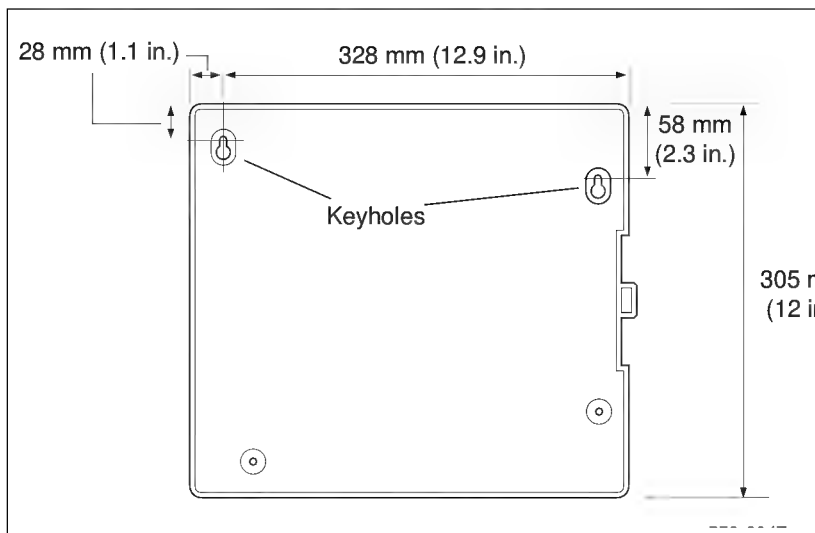
To mount the RPI unit, perform the following steps. For mounting, you need two number 8 round head, 2 in. (50 mm) screws and a screwdriver.

- 1 Position the screw holes for the RPI using the dimensions shown in Figure 50.

To provide adequate ventilation and to prevent overheating, leave a clearance of at least 5 in. (125 mm) around the RPI.

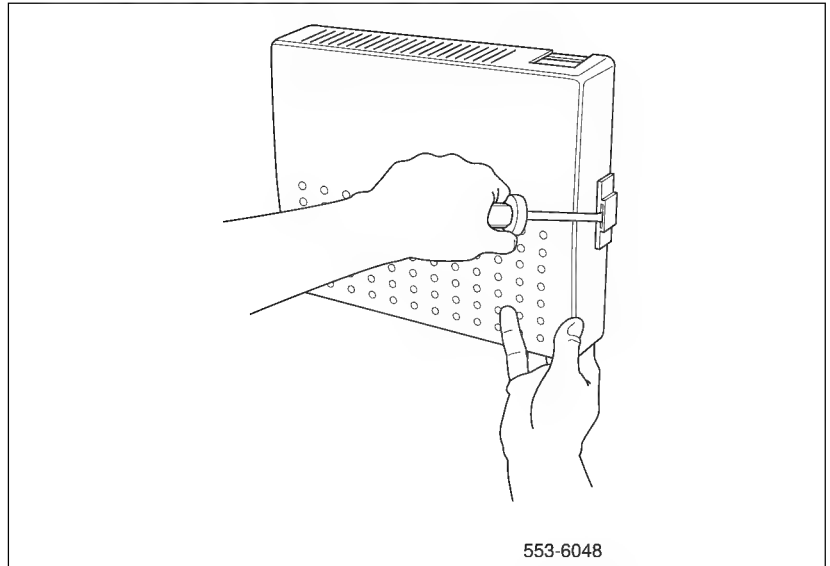
If mounting two RPIs, one above the other, leave a clearance of at least 1 ft (305 mm) between them to provide adequate ventilation and to prevent overheating.

Figure 50
Remote Power Interconnect mounting holes



- 2 Loosely fasten two number 8 round head, 2 in. (50 mm) screws for the keyholes.
- 3 Open the hinged cover by using a screwdriver to lift the release catch on the right side. See Figure 51. You can remove the cover by taking it off its hinges.

Figure 51
Opening a Remote Power Interconnect cover

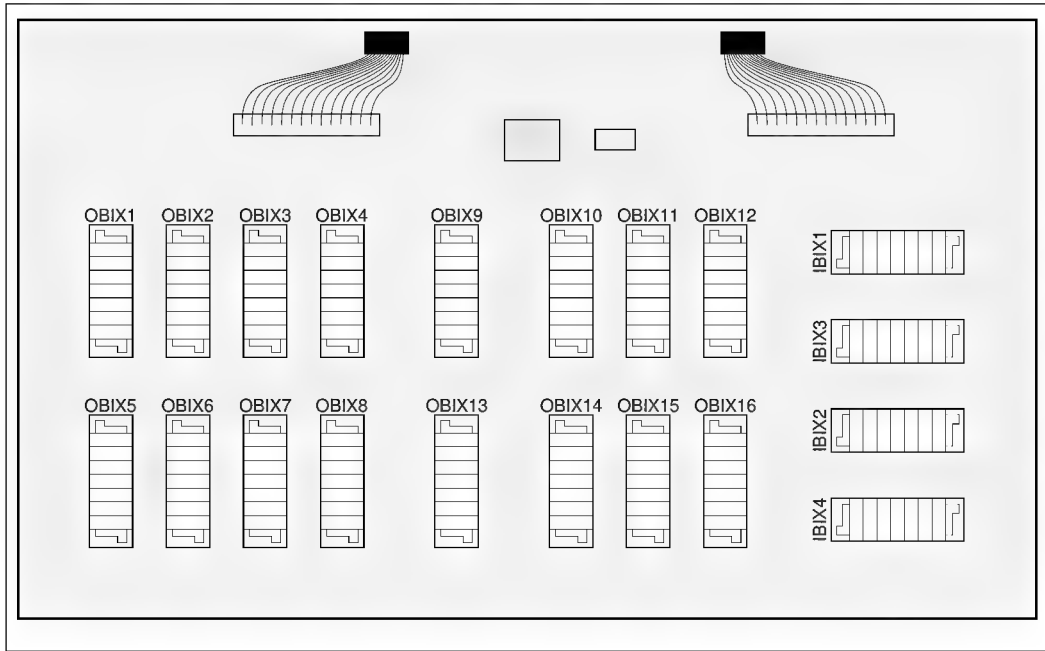


- 4** Hang the RPI on the two keyhole screws and tighten the screws.
- 5** Install the remaining two screws.

Cabling an RPI unit

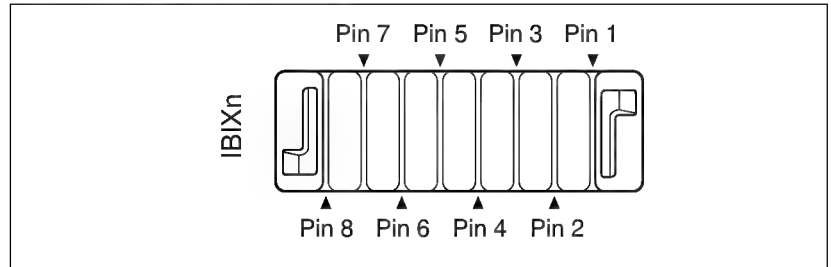
Figure 52 shows the recommended RPI BIX connector board.

Figure 52
Remote Power Interconnect BIX connector board



- 1 Feed the TCM input cable through the top of the RPI and route it to the input connectors as described in “Input connections” on page 145 and illustrated in Figure 53.
- 2 Connect one or two TCM pairs for the AFPS to the appropriate TCM

Figure 53
BIX input connector pinout



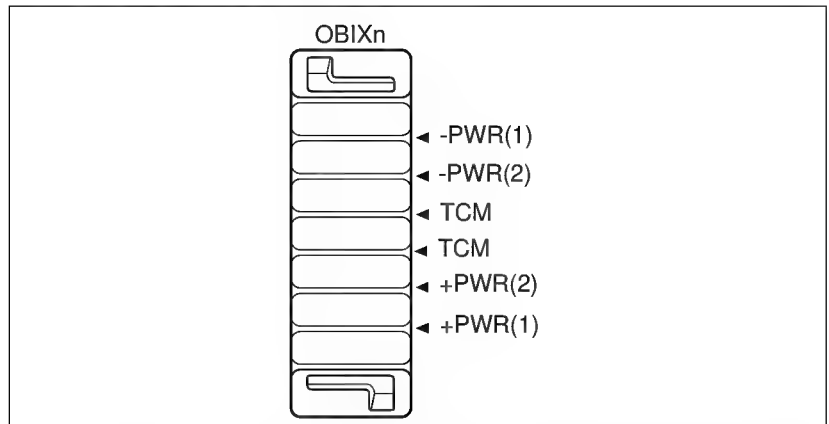
terminals. Table 12 indicates BIX connections.

Table 12
Input wiring

Connector	Pin	Signal	Output connector	Connector	Pin	Signal	Output connector
IBIX1	1, 2	TCM 1	OBIX1	IBIX3	1, 2	TCM 9	OBIX9
	3, 4	TCM 2	OBIX2		3, 4	TCM 10	OBIX10
	5, 6	TCM 3	OBIX3		5, 6	TCM 11	OBIX11
	7, 8	TCM 4	OBIX4		7, 8	TCM 12	OBIX12
IBIX2	1, 2	TCM 5	OBIX5	IBIX4	1, 2	TCM 13	OBIX13
	3, 4	TCM 6	OBIX6		3, 4	TCM 14	OBIX14
	5, 6	TCM 7	OBIX7		5, 6	TCM 15	OBIX15
	7, 8	TCM 8	OBIX8		7, 8	TCM 16	OBIX16

- 3 Feed the TCM output cable through the bottom of the RPI and route it to the output connectors, as described in “Output connections” on page 145 and illustrated in Figure 54.

Figure 54
BIX output connector pinout



- 4 Connect the DC power pair for the AFPS to the power terminals on the same connector as in step 3.

Wiring an RPI unit

CAUTION

**Do not run unprotected power cables outdoors.
The outputs of an RPI unit should not be wired so that its leads
are exposed.**

The maximum two-way DC loop resistance for power pairs is 100 ohms. Table 13 shows the approximate maximum cabling distances from the RPI to the AFPS.

Table 13
Maximum cabling from RPI to AFPS

Wire size	Single-pair	Double-pair
22 AWG	1,475 ft	2,950 ft
24 AWG	980 ft	1,960 ft

Note: Interconnections increase the loop resistance.

Input connections

Feed the TCM input pairs through the top of the RPI and route the pairs to the input connectors IBIX1 to IBIX4. There can be fewer than 16 input pairs.

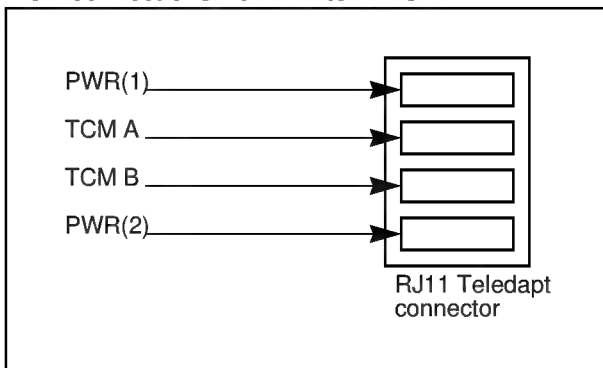
Output connections

Feed the output pairs in through the bottom of the RPI (shown in Figure 52 with a close-up of the pinout connection in Figure 53) and route the pairs to the OBIX output connectors. Only one pair is used for powering an AFPS. Connect the power pair either to -PWR(1) and +PWR(1) or to -PWR(2) and +PWR(2).

TCM connections to the AFPS

The TCM cable from the RPI unit connects to the AFPS through a four-pin teledaptor. The outer two pins need to be connected to the power pair, and the inner two pins to the TCM pair, as figure shows. (The orientation of the respective pairs is irrelevant because these are differential inputs.)

Figure 55
TCM connections from RPI to AFPS



Installing a plug-top power supply for an AFPS

If you do not use an RPI unit, you need to provide a local power source for the AFPS. The plug-top power supply for an AFPS must be located within 12 ft (2 m) of a properly grounded AC outlet. If more than one AFPS is installed at the site, each AFPS needs to use a separate AC outlet.

CAUTION

The outputs of plug-top power supplies should not be wired so that their leads are exposed. A plug-top power supply should be installed in the same building as the AFPS that uses the power supply.

After mounting the AFPS, follow these steps:

- 1 Securely connect the power supply connector to the AFPS power connector, making sure that the connector is inserted in the proper direction.
- 2 Plug the power supply into the AC outlet.

Viewing AFPS LED indicators

On powering up, the AFPS turns on its red LED, which flashes after the AFPS goes through its self-diagnostic test. After the AFPS is unlocked, the LED changes color to green.

Testing the radio frequency (RF) coverage

After installing the Microcellular Base Stations and antenna structure, you need to perform commissioning tests to verify that the MBSs and antennas provide the expected radio frequency (RF) coverage. If the coverage is inadequate or the user density has changed, you can use a number of options to correct the problem. The goal is to fix the problem without changing the cable routing or the antenna installations.

The RF portion of the Microcellular system must be optimized after installation. Optimization involves adjusting transmit levels and properly setting system parameters. These actions will improve voice quality, reduce system messaging, and ensure that the system is functioning properly.

To verify the RF coverage, you need some testing frequencies, which the cellular operator can provide, and some test equipment.

Test equipment

To perform the commissioning tests, you need the following equipment:

- RF power meter +20dBm to -20dBm
- 50-ohm hybrid terminators (6)
- 50-ohm MBS terminators (4)
- ZK-SAM Cellular System Monitor
- Laptop computer
- TRU-II serial interface cable
- Miscellaneous connector adapters to adapt the RF power meter to TNC N-style connectors

Commissioning tests

Commissioning tests verify the basic operation of the MBS, hybrid, antenna coaxial cables, and antennas. Before performing any of these tests, you need to terminate any unused inputs and outputs on the hybrids as well as any unused MBS outputs. To perform the tests for each TRU-II, you need to place the TRU-II in full-screen mode.

Prevent shorting any RF output by always shutting down the TRU-II RF output before disconnecting or connecting cables.

TRU-II full-screen mode

Before placing a TRU-II in full-screen mode, you should place it in a Locked state through the Radio Object Manager on the MSM MAT. If the Microcellular system is not yet operational, then you can skip placing the TRU-II in a Locked state.

The TRU-II supports a VT100 video display terminal (or equivalent) for monitoring, maintenance, and control. By connecting the terminal to the RS-232 interface port on the front panel of the TRU-II, you can enter operation, administration, and maintenance (OA&M) commands. This provides easy set-up of operational and test parameters, status display options, and maintenance operations.

TRU-II to interface terminal connection

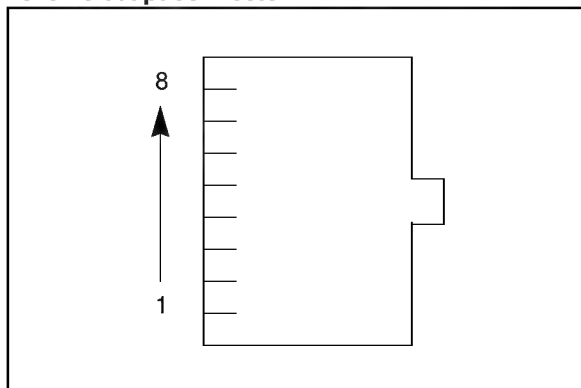
Use a cable with the pinout that Table 14 shows to connect the TRU-II to the interface terminal. Connect the cable to the RJ45 Teledapt connector on the front panel of the TRU-II.

Table 14
Pinouts for TRU-II to interface terminal connection

TRU-II	Interface Terminal			
TRU-II front panel RS-232 port pin number	25 pin D-connector pin number	9 pin D-connector pin number	8 pin Macintosh connector pin number	Function
2	3	2	3	TX from TRU-II
3	2	3	5	RX to TRU-II
7	7	5	4	Ground

In the connector on the TRU-II, the pins number 1 to 8 from bottom to top, or from left to right, as figure shows.

Figure 56
RJ45 Teledapt connector



Full-screen monitor setup

You can operate the terminal interface in command-line mode or in full-screen monitor mode. The same basic commands are available in the command-line mode as well as in the full-screen mode.

The full-screen monitor is the primary user interface to the OA&M capabilities of the TRU-II. Two modes of operation are available: digital mode (TDMA voice) and analog mode (AMPS data).

Connect a VT100 terminal or a PC with a terminal application to the RS-232 port on the front panel of the TRU-II. By pressing the Break key on the terminal keyboard, you can gain access to the command-line mode. The terminal displays the following text:

```
TRU Terminal Interface
(C) Copyright 1990,1991 Bell Northern Research, Inc.
>
```

To enter the full-screen mode, type the following two commands at the command-line prompt (>):

```
>SET LT OFF           (disables the idle timer)
>SET FS ON
```

The SET FS ON command clears the existing display and invokes the full-screen display in the AMPS mode. The full-screen monitor displays the alphabetic codes of the OA&M commands. The monitor displays the results of each OA&M command at specific screen locations.

Figure 57 shows the full-screen displays for TRU-IIs in the TDMA mode and in the AMPS mode. Table 15 summarizes the full-screen commands, and Table 16 through Table 20 describe these commands.

The terminal screen divides horizontally into a status area and a command area. The bottom line of the terminal display is the command area, where you can enter a letter representing a command. Directly above the command area is the output-message line, which displays status and output messages, such as selection parameters and error messages.

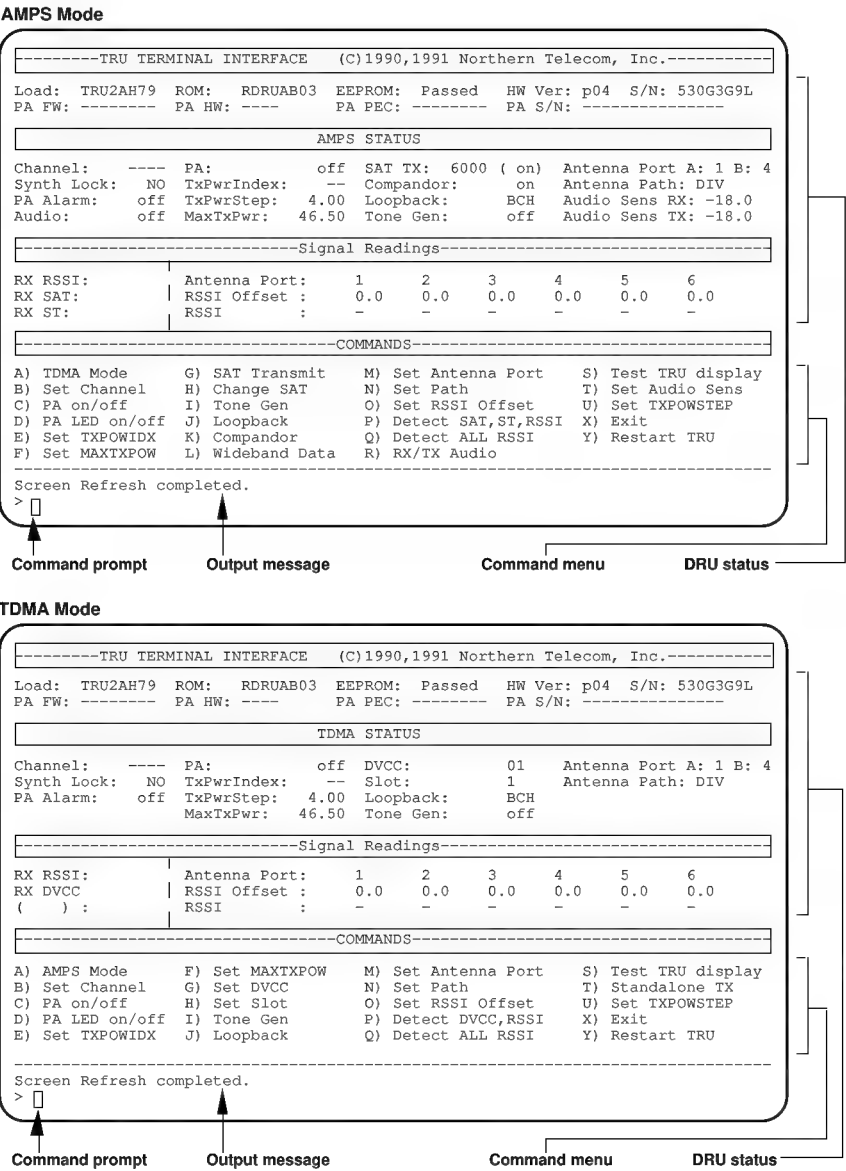
On-line help

To access the terminal interface on-line help, type “HELP” or “?” in response to any prompt. The screen displays a brief description of the TRU-II terminal interface and several on-line help categories. Each category contains a one-

line description of every command in that category. The following categories of help commands are available:

- **HELP HELP** Lists help categories
- **HELP MTCE** Lists maintenance commands
- **HELP TESTS** Lists test commands
- **HELP MSR** Lists measurement and query commands
- **HELP MONITOR** Lists commands within the monitor subsystem

Figure 57
TRU-II full-screen display



Software load verification

Before you perform any RF tests, verify that the software load is correct for the TRU-II. The software release version appears after “LOAD:” in the top left corner of the screen, as in Figure 57.

Full-screen commands

Some commands apply to the TRU-II in only analog or digital mode; others apply only when the TRU-II is in a particular state. Using such a command when the TRU-II is in the wrong mode or state results in the following error message:

That function is not available in the TRU's current state.

You type a command on the command line, at the > prompt, and press the Return key to execute the command. If you need to enter additional parameters, a prompt appears on the message line. Enter the appropriate parameter and press the Return key to execute the command. You can execute only one command at a time.

Use the AMPS mode for testing. The local cellular operator must assign at least one control-channel frequency or voice-channel frequency before you begin the following tests. You can use either kind of frequency for testing, but Nortel recommends using a voice-channel frequency.

Table 15
Full-screen command summary

Code	TDMA Mode Command	AMPS Mode Command
A	Set AMPS Mode	Set TDMA Mode
B	Set Channel	Set Channel
C	Set PA on/off	Set PA on/off
D	Set PA LED on/off	Set PA LED on/off
E	Set TXPOWIDX	Set TXPOWIDX
F	Set MAXTXPOW	Set MAXTXPOW
G	Set DVCC	SAT Transmit
H	Set SLOT	Change SAT
I	Set Tone Gen	Set Tone Gen
L	Set Loopback	Set Loopback
K	—	Set Compandor
L	—	Set Wideband Data
M	Set Antenna Port	Set Antenna Port
N	Set Path	Set Path
O	Set RSSI Offset	Set RSSI Offset
P	Detect DVCC/RSSI	Detect SAT/ST/RSSI
Q	Detect ALL RSSI	Detect ALL RSSI
R	—	Set Rx/Tx Audio
S	Test TRU-II Display	Test TRU-II Display
T	Standalone TX	Set Audio Sens
U	Set TXPOWSTEP	Set TXPOWSTEP
X	Exit	Exit
Y	Restart TRU-II	Restart TRU-II

Table 16 through Table 20 give complete descriptions of the full-screen commands in five groups, according to the functions of the commands:

- Configuration functions for TRU-II operating parameters
- Transmit functions for TRU-II transmit status
- Receive functions for TRU-II receive status
- TDMA mode functions
- AMPS mode functions

Table 16
TRU-II configuration functions

Code	Command	Status	Action/initial value
A	Set Mode	TDMA AMPS	Toggles between the TDMA mode display and the AMPS mode display.
B	Set Channel	0000	Sets the current channel and updates the Channel field on the display. If the TRU-II Synthesizer was able to lock to the specified channel, the Synth Lock field displays "YES"; otherwise, the Channel field displays "----" and the Synth Lock field displays "NO".
D	Set PA LED	on/off	Turns the alarm LED on the front panel of the MPA on or off. The status is shown in the MPA/PA Alarm field.
I	Set Tone Gen	BCH RF Off	Turns on the RF tone generation (1 kHz) on air or turns off the tone generation. The status is shown in the Tone Gen field.
J	Set Loopback	BCH RF Off	Sets the RF Loopback to Mobile or to Off (no Loopback). The status is shown in the Loopback field.
S	Test Display	—	Verifies the TRU-II's 8-character LED display by alternately showing the following three patterns on the LED display until the "Return" key is pressed: 00000000 *****
X	Exit	—	Leaves full-screen monitor mode, clearing the screen and returning to command line mode.

Table 17
TRU-II transmit functions

Code	Command	Status	Action/initial value
Y	Restart TRU-II	W C	Executes either a ROM level reset (C = COLD) or a FLASH level restart (W = WARM). You are prompted for the type of restart to be performed. Note: This will restart the TRU-II and force an exit from the full-screen monitor mode.
C	SetPA on/off	on/off	Turns the MPA and transmitter on or off. The status is shown in the MPA/PA field.
E	Set TXPOWIDX	0..7	Sets the current power level attenuation number. The TRU-II has maximum output power when power level is set at "0" (no attenuation). The status is shown in the Power Level or TxPwrIndex field. Note: It is recommended that the power level be set to "0" unless otherwise specified as a site requirement.
F	Set PA Max Power	-30.50 dBm to -46.50 dBm	Defines the maximum power level (dBm) which maps to an Attenuation Level number of "0" and updates the MPA Power or MaxTxPwr field. Due to the nature of this command, it is not available if you have not previously set the MPA power level. Note: If the MPA is on (C command) and the power level is set (E command), the MPA output power changes immediately when this command is entered.
U	Set Power Step size	1..4	Sets the current MPA power step size number (1.00 dB to 4.00 dB in 0.25 dB steps). The status is shown in the Power Step or TxPwrStep field. Note: It is recommended to set the power step size at "4" unless otherwise specified as a site requirement.

Table 18
TRU-II receive functions

Code	Command	Status	Action/initial value
M	Set Antenna Port	(1 or 2 or 3) (4 or 5 or 6)	Selects antenna ports to use on path A and B. The Antenna Port field will show: Port A: 1, 2 or 3 Port B: 4, 5 or 6
N	Set Path	A B DIV	Selects the antenna path. The status is shown in the Antenna Path field. DIV indicates diversity switching between paths A and B.
O	Set RSSI Offset	00.0	Sets the RSSI Offsets (MCGAIN) for the ports on the specified antenna path. It should be performed during installation only. Do not change the values at this time.
Q	Detect All RSSI	— Signal reading area displays: -000.0	Constantly measures RSSI detected on all the six antenna ports until the "Return" key is pressed. Updates the six RSSI fields on the right hand side of the Signal Readings area on the display. Note: The current path and port settings cannot be determined after this command is executed. The corresponding status fields will be cleared.

Table 19
TRU-II TDMA mode functions

Code	Command	Status	Action/Initial Value
G	Set DVCC	01..FF (hexadecimal)	Sets the Digital Verification Color Code (DVCC) transmitted by the TRU-II when the MPA is enabled. DVCC is an 8-bit verification code transmitted between the mobile and the base station. It is used in TDMA cellular to differentiate between mobiles on the same frequency.
H	Set Slot	1..3	The TRU-II currently supports Full Rate (3 slots) coding, that is, three mobiles sharing one frequency. This command sets the current TDMA slot used by the TRU-II for DVCC transmission and signal measurements.
P	Detect DVCC, RSSI	-000.0 Y/N	Displays if current DVCC setting is detected and/or the RSSI measurement on the current slot of the antenna setup. The status will be displayed in the RX RSSI and RX DVCC fields.
T	Standalone TX	on/off	Enables the TRU-II to transmit without using a PA. This is used for low-power testing.

Table 20
TRU-II AMPS mode functions

Code	Command	Status	Action/initial value
G	Set SAT Transmit	on/off	Turns on/off generation of SAT. The status is shown in the SAT TX field.
H	Change SAT	5970 6000 6030	Sets the transmit SAT frequency. The selected SAT frequency is shown in the SAT TX field.
K	Set Compandor	on/off	Sets TX compression and RX expansion on or off. The status is shown in the Compandor field.
L	Transmit Wideband Data	—	Enables wideband data transmission. The TRU-II will begin to transmit wideband data at the currently selected MPA power level. The wideband data transmission is disabled by pressing the “Return” key.
P	Detect SAT,ST,RSSI	SAT, ST, RSSI or A (all) Signal reading area displays: -000.0	Constantly measures SAT, ST, and RSSI detected on the assigned port of the current path (set by the M and N commands) until the “Return” key is pressed. Updates the RX SAT, RX ST, and RSSI fields on the left hand side of the Signal Readings area on the display. Note: The M and N commands must be set prior to this command.
R	Set RX/TX Audio	TX RX BOTH OFF	TX—unmutes the TX audio; mutes the RX audio. RX—mutes the TX audio; unmutes the RX audio. BOTH (TX RX)—unmutes both TX and RX audio. OFF—mutes both TX and RX audio. The status is shown in the Audio field.
T	Set TX/RX Audio Sens	TX -xx.x RX -xx.x	Sets the audio sensitivity for the entered TX or RX path. The selected audio sensitivity levels are shown in the Audio Sens fields. The limits for the TX and RX audio sensitivity are: TX Sens: -28.0 dBm ≤ -xx.x ≤ -10.0 dBm RX Sens: -28.0 dBm ≤ -xx.x ≤ -16.0 dBm Note: Set both TX and RX Sens to -18.0 in the tests described in this manual.

MBS RF power output test

Measure the power output of the MBS at the four antenna ports at the back of the MBS. The power output value must be greater than 12dBm. 15dBm is nominal.

For each TRU-II, check that the Maxtxpwr parameter value is 15dBm. If it is not, try moving the TRU-II to a different slot, or try a different AMO.

When the test is complete, reconnect the MBS-to-hybrid cable.

Hybrid RF power output test

Measure the power output at all used hybrid ports. For a Dual 8-Port hybrid, the signal loss is typically 7dB. For a Quad 4-Port hybrid, the signal loss is typically 3dB.

Check the unused inputs to the hybrid for isolation. The power level should not be measurable. If the power level is measurable, typically the termination is not there or the hybrid is faulty.

Make sure that all unused inputs and outputs are terminated for these tests.

Antenna cable RF power output test

Measure the power output at the antenna end of each coaxial cable. This power output should equal the power output at the hybrid port minus the expected cable loss. Cable loss equals cable loss per distance multiplied by the cable length. If the cable loss is greater than expected, test the cable with a cable tester to determine whether the cable is faulty.

Antenna coverage test

Antennas should be connected and coverage should be tested. Each antenna should be adjusted to provide at least -85dBm for IS-136 or the best server coverage for IS-54B, or as specified in the deployment plan approved by the cellular operator.

If the antenna coverage is not what you expect, try different heights, or rotate antennas.

Note: At the end of commissioning, you *must* reset all TRU-IIs so that they are in the ROM Idle State. Failure to do this might result in the inability to bring up the microcell.

Microcellular optimization

The optimization process for a microcell has three steps:

- Transmit power setting

Transmit power adjustments are performed to ensure that proper RF coverage exists within the building while keeping outside emissions as low as possible.

- Reselection optimization

Reselection occurs when a mobile leaves or enters the Microcellular coverage area. When the phone enters Microcellular area, it needs to change (reselect) control-channel frequencies from the macrocell control-channel frequency to the microcell control-channel frequency. The reverse happens when the mobile leaves the microcell.

- Handoff optimization

Handoffs occur when the system requires more than a single cell to provide coverage to the site.

Note: The Microcellular system currently does not support handoffs to the public macrocell system.

When a mobile reaches the outer edge of a cell, it needs to hand off to another cell or call quality will decrease. Optimizing handoffs will ensure good voice quality across the entire Microcellular coverage area.

Transmit power adjustments

During Microcellular system commissioning, transmit power adjustments are performed to ensure that proper RF coverage exists within the building, while keeping outside emissions as low as possible.

Downlink

Downlink refers to the RF link from the Microcellular Base Station to the portable. The Microcellular system should have been designed with downlink signal strengths equal to -85 dBm or 17 dB above the noise floor, whichever is the worst case. When the microcell is turned up, a stronger signal strength

is usually observed. This is caused by a conservative design link budget and by a form of diversity created by composite coverage from multiple antennas. Because of the increased coverage, the power level will need to be adjusted to provide optimal indoor coverage with minimal outdoor emissions.

The downlink coverage is adjusted by using the MAXTXPOW parameter in the radio debug mode. MAXTXPOW determines the output power at the TCM RF output ports on the rear of the MBS unit. During the design process, this was assumed to be 12 dBm. The actual maximum value of MAXTXPOW is 15 dBm. In the design process, 12 dBm was used to allow for any needed adjustments when the system was turned up.

An initial value for MAXTXPOW should be chosen using a link budget. A link budget takes into account the gains and losses within the RF system, and can be used to estimate the RF power at each of the Microcellular antennas. This is completed by subtracting the hybrid (if applicable) and coax losses from the MBS output RF power for each antenna cable.

If 0 dBm was used as the test transmitter power level, then the initial value for MAXTXPOW should be chosen to achieve 0 dBm out of as many coax cables as possible.

Example 1

The following installed system was designed with a 0 dBm RF power level output from the antenna end of the cables. The system uses 0.5 inch coax, and a Quad 4-port Hybrid. The following table shows effective radiated power (ERP) at each antenna with MAXTXPOW set to 15 dBm.

Table 21
Effective radiated power

Antenna	Cable length	Hybrid and cable loss	Power into antenna
1	100	5 dB	10 dB
2	200	7 dB	8 dB
3	250	8 dB	7 dB
4	300	9 dB	6 dB
5	250	8 dB	7 dB

The above table shows that the actual cable output powers are much higher than the 0 dBm used when designing the system. A good practice for picking an initial MAXTXPOW would be to decrease the MAXTXPOW from 15 dBm until the longest cable run output power is 0 dBm. In this case, we would decrease MAXTXPOW 6 dBm, or to a value of 9 dBm.

After setting an initial value, adjustment of MAXTXPOW should be completed by measuring the downlink signal strength with a test receiver. Measurements should be made throughout the Microcellular coverage area and outside the building. The collected data should be analyzed to determine if the coverage meets design requirements. This process should be repeated until the coverage meets the design requirements.

If it is not possible to adjust MAXTXPOW to meet outside emission requirements without creating coverage holes elsewhere, in-line attenuators may be used to attenuate “hot” antennas.

Uplink

Uplink refers to the link from the portable to the MBS unit. In a Microcellular system the uplink is much stronger than the downlink. This is because the portable (class IV) has the ability to transmit up to 600 mW, while the MBS can only transmit at 32 mW.

In a Microcellular system, the uplink and downlink paths should be kept as balanced as possible. This will ensure proper system operation and reduce outside building emissions as much as possible.

Once the downlink has been adjusted, the uplink will be adjusted to match the downlink. This is done by setting the TX power level of the portable. The uplink power is set by sending a portable power level to the portable. This power level tells the portable to attenuate its TX power a certain amount of 4 dB steps. The power levels and the related TX powers are shown in the following table.

Table 22
Power levels

Portable Power Level	TX Power
2	27.8 dBm
3	23.8 dBm
4	19.8 dBm
5	15.8 dBm
6	11.8 dBm
7	7.8 dBm
8	3.8 dBm
9	-.2 dBm
10	-4.2 dBm

Using the value of MAXTXPOW, a portable power level should be determined from the above table. If the MAXTXPOW falls between two portable power levels, the lower portable power level should be used for single-cell Microcellular systems. For multicell systems, the lower portable power level should again be chosen, and a parameter called TITO will be used to adjust for the small differences between uplink and downlink. Note that accuracy of power levels 8, 9 and 10 can vary widely and care should be used if they are selected. (8= +3 dbW, 9= +- 6 dbW, 10= +- 9 dbW), The other power levels do not have this variance.

Example 2

In example 1, we determined that the initial MAXTXPOW should be set to 9 dBm. If we assume that the final MAXTXPOW turns out to be 9 dBm, we can

use the above table to determine that the portable power level should be set to 7 with the TITO parameter compensating for the remainder.

The portable power is data filled by setting VMAC/DMAC, MS_ACC_PWR, and Lowest Mobile attenuation to the desired level. These parameters are data filled via the CMCP on the Power sheet, under Cell Properties.

Desired Power

The desired power level setting on a radio is determined as follows:

Desired power = MAXTXPOW + TXPOWSTEP x TXPOWIDX

MAXTXPOW indicates the maximum transmit power setting (in dBm) possible for the given radio. TXPOWSTEP sets the current Modulating Power Amplifier power step size number (1.00 dB to 4.00 dB in 0.25 dB steps). TXPOWIDX sets the current power level attenuation number (0 to 7). The radio has maximum output power when power level is set at "0" (no attenuation).

It is recommended to set TXPOWIDX to 0 and TXPOWSTEP to 0.

TRU-II Setup

MAXTXPOW, TXPOWIDX, TXPOWSTEP and PATYPE are set via a monitor connecting directly to a TRU-II radio. You can operate the terminal interface in command-line mode or in full-screen monitor mode. The same basic commands are available in the command-line mode as well as in the full-screen mode.

Connect a VT100 terminal or a PC with a terminal application to the RS-232 port on the front panel of the TRU-II radio. By pressing the Break key on the terminal keyboard, you can gain access to the command-line mode. The terminal displays the following text:

```
TRU Terminal Interface
(C) Copyright 1990, 1991 Bell Northern Research, Inc.
>
```

To set the parameters from the command-line, enter the following:

```
>SET TXPOWIDX 0
>SET MAXTXPOW ###
```

```
>SET TXPOWSTEP 0  
>SET PATYPE NONE
```

where: ### is the value selected for MAXTXPOW.

PATYPE NONE indicates that the power amplifier used is the internal power amplifier of the radio.

To enter the full-screen mode, type the following two commands at the command-line prompt (>):

```
>SET LT OFF                    (disables the idle timer)  
>SET FS ON
```

The SET FS ON command clears the existing display and invokes the full screen display. You type a command on the command line, at the > prompt, and press the Return key to execute the command. You can execute only one command at a time.

If the TRU-II radio does not accept these commands from either the command-line mode or the full screen monitor mode, try disconnecting the twisted pair cable from the TRU-II radio. Then reconnect the twisted pair cable after the commands have been entered.

Reselection optimization

Reselection occurs when an idle portable moves between cells in a Microcellular system or enters or leaves the coverage area of a private microcell. There are three types of reselection involved: macrocell to microcell, microcell to microcell, and microcell to macrocell.

Macrocell to microcell

When a user enters into the Microcellular coverage area, the portable needs to reselect from the macrocell system to the Microcellular system. This reselection can be controlled by either pointers in the macrocell neighbor lists or within the portable with Public Service Profile/Private Operating Frequencies (PSP/POF) functionality.

There are several possible scenarios in configuring macrocell to microcell reselection.

- 1** If the macrocell is not an IS-136 system (for example, AMPS, CDMA and PCS-1900) PSP/POF portables are required for the microcell.
- 2** PSP/POF portables can also be used in an IS-136 system. If they are used, the macro neighbor cell pointer is not required.

Macrocell neighbor list

If the system is using a macrocell neighbor list, reselection will be controlled by the local cellular operator and not the Microcellular system.

If the macrocell system is IS-136, the macrocell can configure a microcell in its neighbor list as either a “regular” or “preferred” neighbor relationship. If it is a preferred relationship, the portable sees the microcell control channel at a value greater than the SS_SUFF value and reselects to the microcell. If the neighbor relationship is a regular relationship, the portable reselects to the microcell by the RESEL_OFFSET value. In either case, the portable user does not need to do anything. The reselection is automatic.

PSP/POF

PSP/POF enables the portable to be programmed with information about the surrounding macrocell, along with information about the Microcellular system. When the portable enters the overlaying macrocell, the portable recognizes that it is in the vicinity of its home Microcellular system and begins searching for a microcell. This is a preferred neighbor relationship, so once the portable sees a microcell control channel at a value greater than SS_SUFF, the portable reselects to the microcell.

Once the Microcellular system is active, a PSP/POF phone needs to be programmed. This is completed by performing a new system search from the phone. The phone will search the first strongest 24 cellular channels and find any private system. When the phone finds a private system, it will query the user to select the system or keep searching. Once the user selects a system, the phone will attempt to register on that private system. If the registration is successful, the phone will initialize or modify its PSP/POF list by reading the neighbor list information on both the macro and micro. All reselection information will be included in these lists.

Within a multicell Microcellular system, each cell needs to have every cell in the system defined as a neighbor. This will allow the phone to download all the private operating frequencies, making sure that the phone can reselect from the macrocell to any of the Microcellular cells.

SS_SUFF is data filled on the Portable Access sheet under Cell properties. For information on cell properties, see “Completing cell configurations” on page 350. It should be set to the microcell downlink threshold that is reached just upon entering the building. SS_SUFF is also the threshold for leaving the cell, so be careful not to set SS_SUFF too high or there might be points throughout the building where the phone will reselect to the macrocell. SS_SUFF is data filled as an integer and mapped to an RSSI value.

Microcell to macrocell

When the portable leaves the private Microcellular coverage area, it reselects from the private microcell to the public macrocell. This neighbor cell relationship should be defined as a nonpreferred reselection candidate. When the signal strength of the microcell falls below the data-filled SS_SUFF value of the microcell, the reselection process is triggered. If the macrocell signal strength is greater than the microcell signal strength by RESEL_OFFSET, and greater than the macrocell's SS_SUFF, for a time equal or greater than DELAY, the portable will reselect to the macrocell.

The microcell SS_SUFF parameter is data filled on the Portable Access sheet under Cell properties, as described in the macrocell to microcell, PSP/POF section above.

Macrocell SS_SUFF is data filled on the Configuration sheet under External Cell properties. SS_SUFF is data filled as an integer and mapped to a RSSI value. For information on External Cell properties, see “Configuring external cells” on page 373.

DELAY and RESEL_OFFSET are data filled on the Neighbor Cell Configuration screen. DELAY is in seconds and RESEL_OFFSET is data filled as an integer and mapped to a RSSI value.

If there is poor macrocell coverage outside the Microcellular coverage area, the RSS_ACC_MIN parameter should be used to force users off the Microcellular system when they are outside the desired Microcellular coverage area. This will keep users from originating calls with poor voice quality in areas with poor cellular coverage (micro or macro).

RSS_ACC_MIN should be set at a value 5 dB below the lowest microcell signal in the desired coverage area.

RSS_ACC_MIN is data filled on the Portable Access sheet under Cell Properties. RSS_ACC_MIN is data filled as an integer and mapped to a RSSI value. For information on Cell Properties, see “Completing cell configurations” on page 350.

Microcell to microcell (for multiple-cell systems)

When the portable moves around a multiple-cell Microcellular system, it needs to reselect between the cells.

When you data fill internal microcell neighbors, they should be defined as regular reselection neighbors. This is done by setting Celltype to regular on the Neighbor Cell Configuration property page.

Once the neighbor lists are data filled, the portable will continually scan the neighbor cells. Because internal microcell neighbors are data filled as regular reselection candidates, the portable only looks to see if the candidate cell is stronger than the serving cell by RESEL_OFFSET. Once this is met for a data filled delay, the portable will reselect to the candidate cell. The delay is used to prevent the portable from constantly reselecting between two cells (ping pong) when it is in an overlapping area.

RESEL_OFFSET should be set to -6 dB and adjusted if reselection is dragging or occurring too soon.

RESEL_OFFSET is data filled on the Neighbor Cell Configuration screen. RESEL_OFFSET is data filled as an integer and mapped to a RSSI value. For information on Neighbor Cell properties, see “Configuring neighbor cells” on page 377.

Handoff optimization

If a Microcellular system covers a large area or has many users, there may be a need to have multiple cells within the system. When a system has multiple cells, handoffs between these cells will be needed.

Handoffs enable the system user to make a call and travel around the system without ending the call. When the user approaches the edge of a cell, the system will tell the portable to hand off to the adjacent cell.

The system makes the decision to hand off the call from the RF signal levels on the uplink and downlink. When the uplink signal strength falls below a certain data filled value, handoff threshold low (HOTL), the system triggers a handoff request. Once a handoff request is triggered, the system instructs the portable to take downlink control-channel signal strength measurements of the candidate cells and the serving cell. If a candidate signal strength is greater than the serving signal strength plus a delta, it is a valid handoff candidate. The system then takes the strongest of the valid candidates and instructs the portable to hand off to that cell. If none of the candidate cells signal strengths are greater than the serving signal strength plus the delta, then system will instruct the portable to remain on the current cell. This type of handoff is called mobile assisted handoff (MAHO), because the portable makes the measurements that the handoff is based on.

Handoff neighbors are data filled from the Cells screen under the configuration menu. The following handoff parameters are configured via the CMCP.

Uplink RSSI Handoff Threshold Low (HOTL)

This is the uplink signal strength at which the system will trigger a handoff. HOTL should be set low enough to avoid signal fading and coverage lows between antennas within a cell, but not so low as to drag a call too far into a cell. Dragging a call can cause problems with voice quality and interference. If HOTL is set too high, there will be problems with too much messaging on the system caused by excessive handoff requests.

HOTL should be determined by measuring uplink signal strength at the cell boundaries. Uplink signal strength is measured by using a PC with a communications program (for example, Hyper Terminal) to connect to the TRU-II maintenance port. A call is then placed near the physical boundary of the cell, and the “q rssi” command is issued from the PC to read the uplink signal strength.

For single-cell Microcellular systems, HOTL should be set to -125 dBm. This will disable handoffs in the system.

HOTL is data filled on the Thresholds sheet under Cell properties. For information on Cell properties, see “Completing cell configurations” on page 350.

HO Delta

The delta is the amount of RSSI by which a candidate has to be stronger than the serving cell to hand off. The purpose of the delta is to keep the system from performing repeated handoffs between two cells (ping-ponging) when a portable is at a cell boundary. This should be set to 3 dB and increased if ping-ponging occurs, and decreased if call dragging occurs. Every handoff pair will have a delta that is data filled on the Configure sheet under Neighbor Cell properties. For information on Cell properties, see “Completing cell configurations” on page 350.

RSSI Sample Rate

When the portable is instructed to report back the RSSI for the candidate and serving cells, it does so in 1 second samples. RSSI sample rate is the number of these samples that should be averaged before making a handoff decision. RSSI sample rate should be set to 2. If there is a problem with handoff ping-ponging, the value can be increased, but if its increased too much it will cause the call to drag. RSSI sample rate is data filled on the Power sheet under Cell properties. For information on Cell properties, see “Completing cell configurations” on page 350.

ERP Delta

ERP delta is a value used to adjust for differences between the control-channel TX power and voice-channel TX power. The adjustment is needed because handoff decisions are based on control-channel measurements, but affect voice channels. In a Microcellular system, this parameter should be set to 0, because there are no differences between the control-channel and voice-channel TX powers. ERP delta is data filled on the Power sheet under Cell properties. For information on cell properties, see “Completing cell configurations” on page 350.

TCH Talk-in/Talk-out (TITO)

TITO is used to adjust differences between the uplink and downlink voice-channel signal strengths. This should be used to adjust the differences between portable TX power and MBS TX power. TITO should be set to 0, 1, 2, or 3 dB, depending on the difference between the portable TX power and MBS TX power. TITO is data filled on the Power sheet under Cell properties. For information on Cell properties, see “Completing cell configurations” on page 350.

The following table can be used to determine the proper value of TITO for a given MBS output power.

Table 23
Talk-in/Talk-out values

MBS Output Power dBm	Portable Power Level dBm	TITO dB
15	5	0
14	6	3
13	6	2
12	6	1
11	6	0
10	7	2
9	7	1
8	7	0
7	8	3
6	8	2
5	8	1
4	8	0
3	9	3
2	9	2
1	9	1
0	9	0

Common RF system problems

Table 24 lists some common problems an RF system might have and some solutions for these problems.

Table 24
Troubleshooting RF system problems

Problem	Cause	Action(s)
MBS alarms all on	APS switch settings are incorrect.	Make sure that all SW5 switches are down (closed).
Cannot set TRU-II channels	CSMO warm-up period is about 20 minutes.	Wait until the alarm lamp goes out.
No display on TRU-II #1, #2, #3, or #4	Possibly the 28V fuse has blown.	Replace the fuse with the spare fuse.
Portable unable to find control channel	There is a system software problem if the display does not include an asterisk (*): ACC, or DCC.	Check the TRU-II LED display. One TRU-II should show ACC or DCC with an asterisk. Check the system software for problems like radios not connected, software not running, and so on.
Dead spot in coverage	A low RSSI reading might indicate a loose connection at an antenna or hybrid. If the RSSI reading is OK, the user's portable might have a problem.	Use a portable to read the RSSI level in the area. Check the TNC connections. Check the user's portable.

Installing Microcellular cards

Installation of a Microcellular system requires installing at least one EIMC card and one MXC card on the IPE shelf and one MISP card on the network shelf of a Meridian 1 Option 51C, 61C, 81 or 81C system. For an Option 11C system, the Microcellular system requires one EIMC card in the main cabinet and at least one MXC card in the main cabinet or in an expansion cabinet; an Option 11C system does not use an MISP or XNET and XPEC cards.

You can install additional cards, as described in this section. To determine which cards and how many to install, refer to the site planning documents for the Microcellular system you are installing.

Even if the Meridian 1 system already has an MISP card for ISDN, you need to install an additional MISP card for the Microcellular system.

This section provides information about where to install the Microcellular cards. For details about installing a card in a Meridian 1 system, see *System installation* (553-3001-210).

For replacement procedures for Microcellular cards, see the *Nortel COMPANION Microcellular Operations, administration, and maintenance guide* (553-3611-300).

Multipurpose ISDN Signaling Processor (MISP) card

Before you configure the Microcellular components on an Option 51C, 61C, 81, or 81C Meridian 1 system, you need to install a MISP card for the Microcellular system. For Option 51C, 61C, or 81C, place the MISP in the Core-Net module in any slot from 0 to 7. For Option 81, place the MISP in the Net module in any slot from 5 to 12.

One MISP card serves up to 8 EIMCs. The MISP provides routing and message relays between a Meridian 1 CPU and an EIMC. The MISP interfaces to the core CPU through the CPU (CE) Bus interface and interfaces to the EIMC through a B-Channel connection over the network bus.

In Option 11C, the EIMC communicates directly with the SYCOM using its CE/MUX bus interface.

Embedded Intelligent Mobility Controller (EIMC) card

Install at least one EIMC card on the Meridian 1 system that includes the Microcellular system. For the number of EIMC cards to install, refer to the site planning and deployment design documents for the Microcellular system.

On an Option 51C, 61C, 81, or 81C system, install each EIMC card in any slot in an IPE shelf connected to the Meridian 1. To eliminate local switching conflicts, these systems are limited to one EIMC per IPE shelf.

In an Option 11C system, install the EIMC card in the main cabinet. To eliminate local switching conflicts, Option 11C systems are limited to one EIMC.

Each EIMC supports a maximum of 15 Microcellular Transcoder Cards (MXCs) per IPE shelf. In a single superloop configuration, the Microcellular system can support a maximum of 12 MXCs on the same IPE shelf. The EIMC and its MXC cards do not have to be in contiguous slots.

Microcellular Transcoder (MXC) cards

Before you configure the Microcellular components, install at least one MXC card on the Meridian 1 system that includes the Microcellular system. For the number of MXC cards to install, refer to the site planning and deployment design documents for the Microcellular system.

With 2ccs per portable and 2% radio-channel blocking at the MBS, the Microcellular system can support a maximum of 12 MXCs per IPE shelf for each superloop configuration.

You can install from 1 to 15 MXC cards on each IPE shelf in an Option 51C, 61C, 81, or 81C system, or from 1 to 15 MXC cards in the main cabinet or expansion cabinets on an Option 11C system. The MXC cards and their supporting EIMC card do not have to be in contiguous slots.

The MXC provides eight TCM loop interfaces to the Microcellular Base Stations (MBSs) for VSELP only or four TCM loop interfaces for ACELP/VSELP—each MBS uses up to four TCM interfaces (one per TRU-II). Each TCM interface is two wires (single-twisted pair). No loop powering is provided across this interface.

The MXC can support one control-channel radio and up to seven traffic-channel radios for VSELP service or one control-channel radio and up to three traffic-channel radios for combined ACELP/VSELP service. For TDMA-3 voice calls, the MXC provides multiplexing/demultiplexing, vocoder, and loss/level functions. For AMPS data calls, the MXC provides only multiplexing/demultiplexing (rate adaptation). (The Microcellular system does not support AMPS voice calls.)

Peripheral Equipment Controller (XPEC)

An XPEC is required in an Option 51C, 61C, 81, or 81C system for normal operation of the IPE shelf and for the Microcellular implementation. The main function of the XPEC for the Microcellular system is to provide the EIMC access to its R72 TSIC for Microcellular switching functions. The XPEC receives DS-30X D-channel messages from the EIMC that contain connection information, which the XPEC uses to program its R72 connection memory.

Configuring Microcellular components

This section describes how to configure a Microcellular components through the Mobility System Management (MSM) application running on a local or remote Meridian Administration Tool (MAT). You connect to a Meridian 1 system through the MAT and configure the Microcellular components in order through MSM. During component configuration, the cellular operator provides the RF parameters for cells, including the frequencies for voice channels and control channels.

Microcellular components operate in an hierarchy. Child components cannot exist without their parent component(s). Therefore, you must configure a parent component before its child components. When unlocking components, you need to follow the same order.

If you need to delete a parent component, you must delete all of its child components first. This restriction guarantees that all components have valid links to their parent and child components, reducing the chance of an invalid Microcellular system configuration.

Note: Some components have more than one parent component. For these child components, both parent components must exist before you can create the child component.

Configuration order

You should configure Microcellular components in the following order, as the rest of this section describes in detail:

- 1 MISP (for Options 51C, 61C, 81, and 81C)
- 2 MSPRE subsystem properties
- 3 EIMCs

- 4 MXCs
- 5 Zones
- 6 Cells
- 7 External cells (optional)
- 8 Neighbor cells (optional)
- 9 MBSs
- 10 TRU-IIs (radios)
- 11 AFP Region and Stations
- 12 Portables
- 13 Multi-Site Networking (optional)

For adding and configuring each type of component, the Mobility System Management application has an object manager window and one or more property sheets.

For information about configuring portables, see “Configuring portable telephones” on page 251.

For information about configuring the optional Meridian Multi-Site Networking (MMSN) feature, see *Nortel COMPANION Microcellular Multi-Site Networking Description, operations, and administration* (553-3611-110).

Object manager commands and controls

The MAT Navigator window provides access to all Meridian 1 systems to which the MAT connects. From the Navigator window, you can open a System window for any of these Meridian 1 systems.

From the MAT System window for a Meridian 1 system, you can open all the MSM object managers. The object managers can add, unlock, lock, and delete Microcellular components. From an object manager window, you can open the object property sheet, which has tabbed pages on which you can enter configuration information for a component.

Table 25 lists the menu commands that you can use in the object manager windows.

Table 25
Object manager menu commands

Command Name	Action	Menu
About Object	Displays the About box for the object manager window.	Help
Add	Adds a new object based on the default template for that object type and opens the property sheet.	Configuration
Close	Closes the object manager.	File
Copy	Places the configuration of the selected object(s) on the clipboard, from which you can paste the data into other applications as tab-delimited data.	Edit
Delete	Deletes the selected object after displaying a confirmation dialog that enables you to cancel the command. Displays a failure dialog if the object manager cannot delete the object (for example, if it is a parent of an existing object).	Configuration Object
Forced Download	Forces a software download to the selected object.	Maintenance Object
Help Topics	Displays the Help topics dialog, which contains Contents, Index, and Find tabs. This dialog is a standard Windows 95 component.	Help
Lock	Locks the selected object after displaying a confirmation dialog that enables you to cancel the command.	Maintenance Object
Print	Prints a report for the selected object(s).	File
Print Preview	Displays a report in the Print Preview window.	File
Print Setup...	Displays the standard page setup dialog, for selecting printing parameters.	File
Properties	Opens the property sheet for the selected object.	File, Object
Reports...	Displays the Reports dialog box, which list reports relevant to the object manager window and enables you to preview or print each report.	File

Command Name	Action	Menu
Select All	Selects all the objects in the object manager.	Edit
Status Bar	Toggles the display of the status bar in the object manager window.	View
Test	Performs a test on the selected object. The object manager displays the results in the results text box at the bottom of the window.	Maintenance Object
Toolbar	Toggles the display of the tool bar in the object manager window.	View
Unlock	Returns the selected object(s) to the unlocked state.	Maintenance Object
What's This?	Displays a pointer that you can use to obtain help information on an object by pointing to it.	Help

On each property sheet page, you can choose, edit, or enter values to configure the object. The cellular operator enters much of the configuration information on the property sheet pages for zones, cells, and AFP regions, as “Cellco Mobility Control Point (CMCP)” on page 293 describes.

Table 26 lists the buttons that you can use on object manager property sheets.

Table 26
Object manager property sheet buttons

Button	Action
OK	Saves any changes to attribute values and closes the property sheet.
Cancel	Closes the property sheet without saving any changes to attribute values since the property sheet opened or since Apply saved the attribute values.
Apply	Saves any changes to attribute values without closing the property sheet.
Help	Displays the Help text for the current page of the property sheet.

Object states and substates

The object manager windows display the states and substates of objects that you add to the Microcellular system.

Table 27 describes the operational, administrative, and usage states of Microcellular objects.

Table 27
Object manager state and substate columns

State or substate	Description
Enabled	Partially or fully operational
Disabled	Not operational
Locked	Instructed not to provide service
Unlocked	Instructed to provide service
Shut down	Instructed to shut down after providing service to existing active calls; does not accept new requests for service
Idle	Available but not in use
Active	In use, with capacity for additional service
Busy	In use, with no spare capacity
Partially Configured	Component with missing or invalid settings
Not installed	Component configured correctly but corresponding hardware not present or not detectable
Initialization Required	Component waiting for Unlock operation
Initializing	Device initialization in progress
Containment Failure	Sibling component not operational
Dependency Failure	Parent component not operational
Degraded	One or more sibling components not operational, but service available through other sibling component

Configuration procedure

To configure a Microcellular system, you can perform the following procedure, which the rest of this section describes in detail:

- 1** Connect to the Microcellular Meridian 1 system through the MSM MAT. (“Connecting MSM to a Meridian 1 system” on page 191)

If a MAT is not installed for the Meridian 1 system, follow the instructions for installing the MAT in the *Meridian Administration Tools Common Services User guide* (A0658266).

If a MAT is installed but the Meridian 1 system is not available through the MAT, see “Setting up the MAT” on page 49, or follow the instructions for configuring sites, systems, and users in the *Meridian Administration Tools Common Services User guide* (A0658266).

- 2** Configure the Meridian 1 MISP card. (“Configuring a MISP card” on page 195)

For an Option 51C, 61C, 81, or 81C Meridian 1 system, configure a MISP object for the Microcellular system through overlay 27 and enable the MISP through overlay 32. You can use the overlays from the System window’s overlay pass-through to the Meridian 1 system.

- 3** Configure the MSPRE subsystem properties. (“Configuring a Microcellular subsystem” on page 197)

The cellular operator configure other subsystem properties. (“Configure maximum number of portables” on page 339)

- 4** Configure the Meridian 1 EIMC and MXC cards.

- a** Add and configure at least one EIMC card through the EIMC Object Manager window. (“Configuring EIMCs” on page 203)
- b** Add and configure at least one MXC card through the MXC Object Manager window. (“Configuring MXCs” on page 209)

- 5** Partially configure the Microcellular zones, cells, MBSs, radios, and AFP region, and configure the AFP Stations:
 - a** Add and configure at least one zone through the Zone Object Manager window. (“Configuring zones” on page 215)
 - b** Add and configure at least one cell through the Cell Object Manager window. (“Configuring cells” on page 221)
 - c** Add and configure at least one MBS for each cell through the MBS Object Manager window. (“Configuring Microcellular Base Stations” on page 227)
 - d** Add, configure, test, and download software to at least two TRU-IIs for each cell. (“Configuring radios” on page 231)
 - e** Configure the AFP region and add and configure at least one AFP Station through the AFP Region Object Manager window. (“Configuring the AFP region and Stations” on page 239)

- 6** Unlock the Microcellular objects after the cellular operator configures neighbor cells and external cells and completes the zone, cell, and AFP region configurations. (“Initializing a Microcellular system” on page 247 and “Configuring and maintaining Microcellular systems” on page 334)

Option 1: Seed traffic frequencies and manually program external cells

- a** The cellular operator configures neighbor cells.
- b** The cellular operator adds external cells for neighbor cells.
- c** The cellular operator completes zone and cell configurations, including entering radio frequencies and enabling AFP for cells through the CMCP.
- d** The cellular operator configures the AFP region parameters.
- e** The distributor unlocks the AFP region object.
- f** The distributor unlocks each EIMC, MXC, and zone, the cell or cells within each zone, and then the radios in each cell.

Option 2: Have AFP pick traffic frequencies and manually program external cells

- a** The cellular operator configures neighbor cells.
- b** The cellular operator adds external cells for neighbor cells.
- c** The cellular operator completes zone and cell configurations, including enabling AFP for cells but not entering radio frequencies.
- d** The cellular operator configures the AFP region parameters.
- e** The distributor makes sure that all the Microcellular components except the subsystem are locked.
- f** The distributor unlocks the AFP region and waits for *convergence*, a stage in which AFP has generated a set of stable backup frequencies. Convergence can take from two hours to three days, depending on the Microcellular system configuration and the AFP parameters set through the CMCP.
- g** After AFP reaches convergence, the distributor unlocks each EIMC, MXC, and zone, the cell or cells within each zone, and then the radios within each cell.

Option 3: Seed traffic frequencies and have AFP configure external cells

- a** The cellular operator completes zone and cell configurations, including entering radio frequencies and enabling AFP for cells through the CMCP.
- b** The cellular operator configures the AFP region parameters.
- c** The distributor unlocks the AFP region object.
- d** The cellular operator waits for external cells to be automatically configured.
- e** The cellular operator configures neighbor cells.
- f** The distributor unlocks each EIMC, MXC, and zone, the cell or cells within the zone, and then the radios for each cell.

Option 4: AFP selects traffic channels and configures external cells

- a** The cellular operator completes zone and cell configurations, including enabling AFP for cells through the CMCP but not entering traffic channels.
- b** The cellular operator configures the AFP region parameters.
- c** The distributor makes sure that all the Microcellular components except the subsystem are locked.
- d** The distributor unlocks the AFP region object.
- e** The cellular operator waits for external cells to be automatically configured.
- f** The cellular operator configures neighbor cells.
- g** After AFP reaches convergence, the distributor unlocks each EIMC, MXC, and zone, the cell or cells within each zone, and then the radios within each cell.

- 7** With the cellular operator, configure portables and, optionally, a buffer box (you can do this while waiting for convergence or automatic configuration of external cells). (“Configure maximum number of portables” on page 339, “Configuring portable telephones” on page 251, and “Monitor alarms and operational measurements” on page 386)

 - a** The cellular operator specifies the maximum number of portables.
 - b** The cellular operator selects the encrypted ESN option, if desired.
 - c** The cellular operator provides the portable Mobile Identification Numbers (MINs) and Electronic Serial Numbers (ESNs).
 - d** The cellular operator provides the directory number(s) for alarm and operational measurements (OM) notification.
 - e** The distributor configures the portables with the Mobile Identification Numbers (MINs) and Electronic Serial Numbers (ESNs) provided by the cellular operator.
 - f** The distributor configures the buffer box, including directory number(s) for forwarding alarms and OMs.
- 8** With the cellular operator, verify the installation, using a configured portable to test the system. (“Verifying Microcellular system installation” on page 265)

 - a** The distributor and the cellular operator commission the Microcellular system (setting uplink and downlink power levels and making sure that antennas are pointing correctly).
 - b** The cellular operator and the distributor test call placement and reception.
 - c** The cellular operator and the distributor perform RF optimization (testing reselection and call handoff for multiple cells and adjusting pertinent parameters).
 - d** The cellular operator and the distributor troubleshoot any portable problems.
 - e** The cellular operator and the distributor test Microcellular interference outdoors.

If you experience a problem during the configuration, you might need to delete one or more objects and then start the configuration from where the problem occurred. See “Deleting objects from MSM” on page 245.

If you are upgrading from a VSELP to an ACELP system, see “Upgrading from VSELP to ACELP” on page 271.

Connecting MSM to a Meridian 1 system

This section describes how to connect to a Meridian 1 Microcellular system through the Mobility System Management (MSM) application running on a local or remote Meridian Administration Tool (MAT). You connect to a Meridian 1 system through the MAT and configure the Microcellular components in order through MSM object managers.

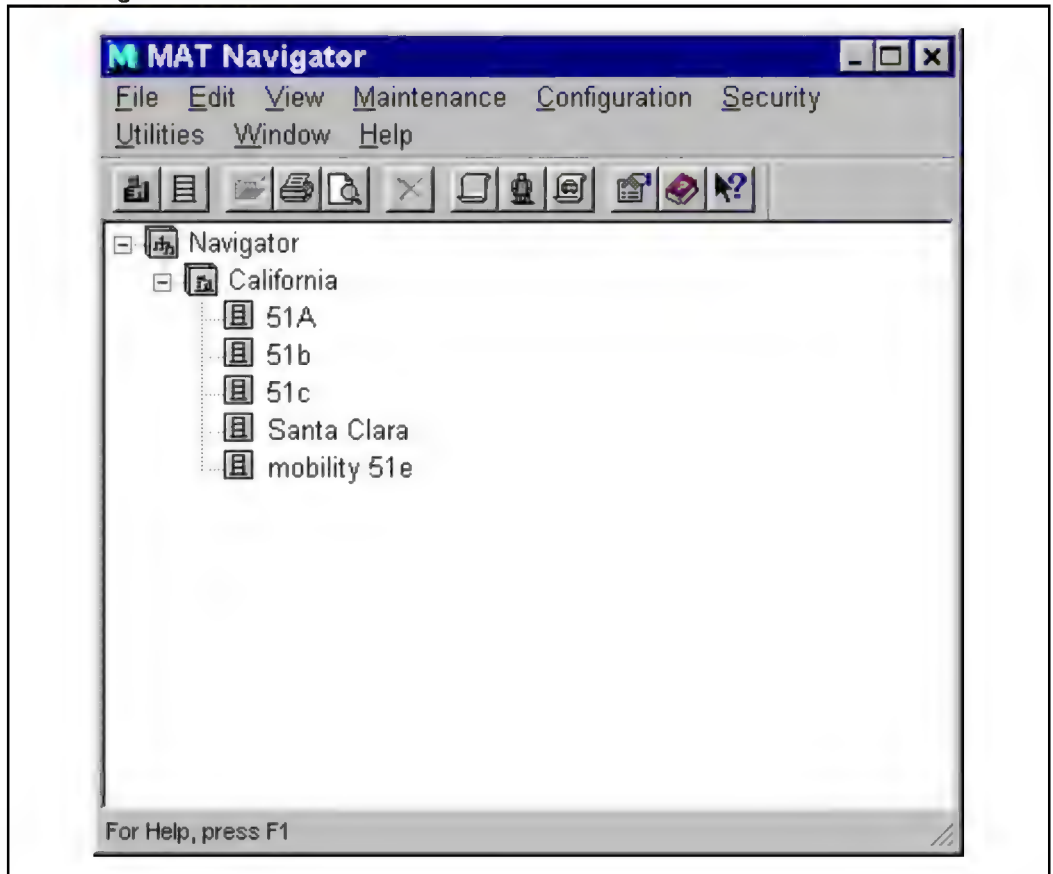
For information about setting up an MSM MAT, see “Setting up the MAT” on page 49.

To begin the Microcellular configuration, connect to the Meridian 1 system that includes the Microcellular system through the MAT Navigator window:

- 1** To start the MAT software, select **MAT** in the Start menu **Programs** list.
- 2** In the MAT login dialog box, enter your MAT user ID and password and click **OK**.

The MAT Navigator window appears. Figure 58 illustrates the Navigator window.

Figure 58
MAT Navigator window



The Navigator window contains icons that represent Meridian 1 sites. You can expand the tree to display systems within each site.

For more information about the MAT Navigator window, see the *Meridian Administration Tools Common Services User guide* (A0658266).

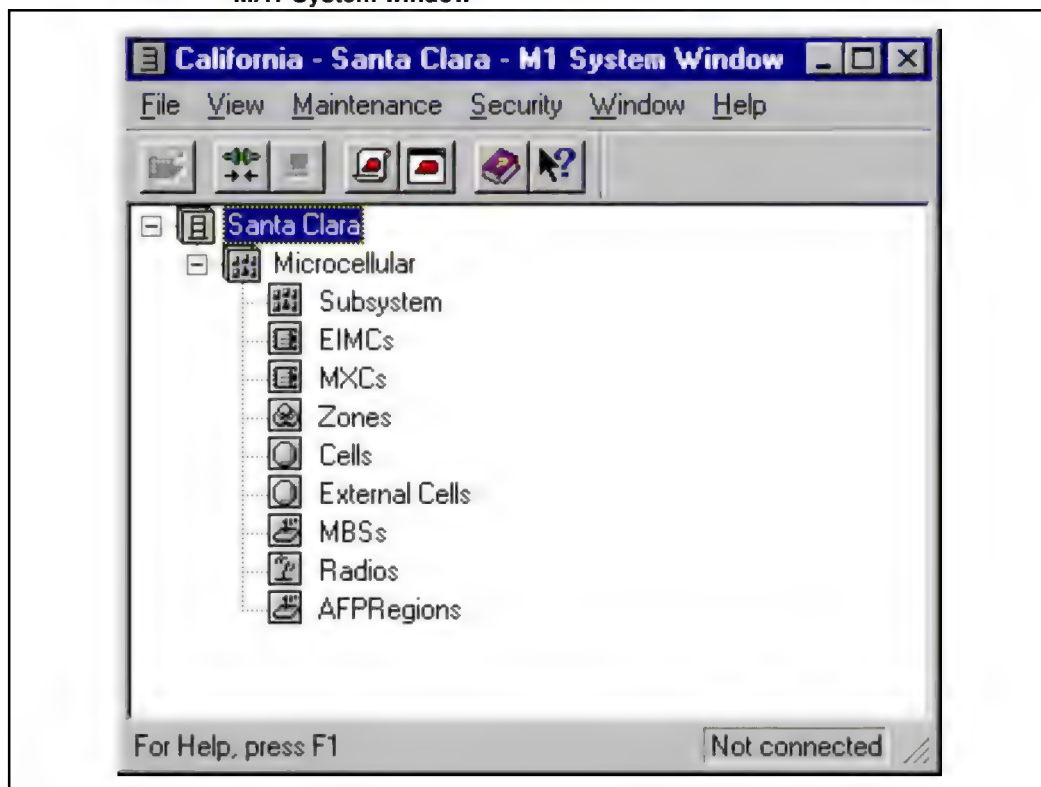
- 3 Double-click the icon of the Meridian 1 system that includes the Microcellular system, or highlight the Meridian 1 system and select **Open** from the **File** menu.

The Meridian 1 system should have been added to the MAT and configured during MAT installation. If the icon for the Microcellular Meridian 1 system does not appear in the Navigator window, follow the instructions in “Setting up the MAT” on page 49.

- 4 In the Meridian 1 login dialog box, enter your Meridian 1 user ID and password.

This opens a MAT System window for the Meridian 1 system, which Figure 59 illustrates.

Figure 59
MAT System window



The System window gives you access to Microcellular object managers. The object manager icons in this window represent the Microcellular subsystem within the Meridian 1 system. You can use the object managers to add, configure, and unlock Microcellular components, as later sections describe.

If the Microcellular icon does not appear in the System window, you need to give the MAT access to the Microcellular system in the System Properties window (select **Properties** from the **File** menu).

Configuring a MISP card

To configure a MISP card for a Microcellular system on an Option 51C, 61C, 81, or 81C Meridian 1 system, use overlay 27 to specify the MISP configuration and overlay 32 to enable the MISP.

At the top of the MAT System window, click the overlay icon to launch the overlay pass-through to the Meridian 1 system.

Note: If a MISP card dedicated to the Microcellular system is not installed on the Meridian 1 system, you need to install the card first. For installation instructions, see “Multipurpose ISDN Signaling Processor (MISP) card” on page 175.

Table 28 shows the Overlay 27 configuration for the MISP for a Microcellular system.

Table 28
MISP configuration (LD 27)

Prompt	Response	Description
REQ	NEW	
TYPE	MISP	Multipurpose ISDN Signaling Processor
LOOP	0, 2, 4, ... 158	MISP loop number
APPL	MOB	Mobility Routing Application

To enable the MISP card, enter the following commands for maintenance overlay 32:


```
LD32
STAT (loop)
ENLL loopnumber
```

In the ENLL (Enable Network Loop) command, *loopnumber* is the MISP loop number.

When you enable the MISP card for the first time, the software download might take up to a minute to complete.

For more information on configuring and enabling a MISP card, refer to the section on configuration procedures in *ISDN Basic Rate Interface administration* (553-3901-301).

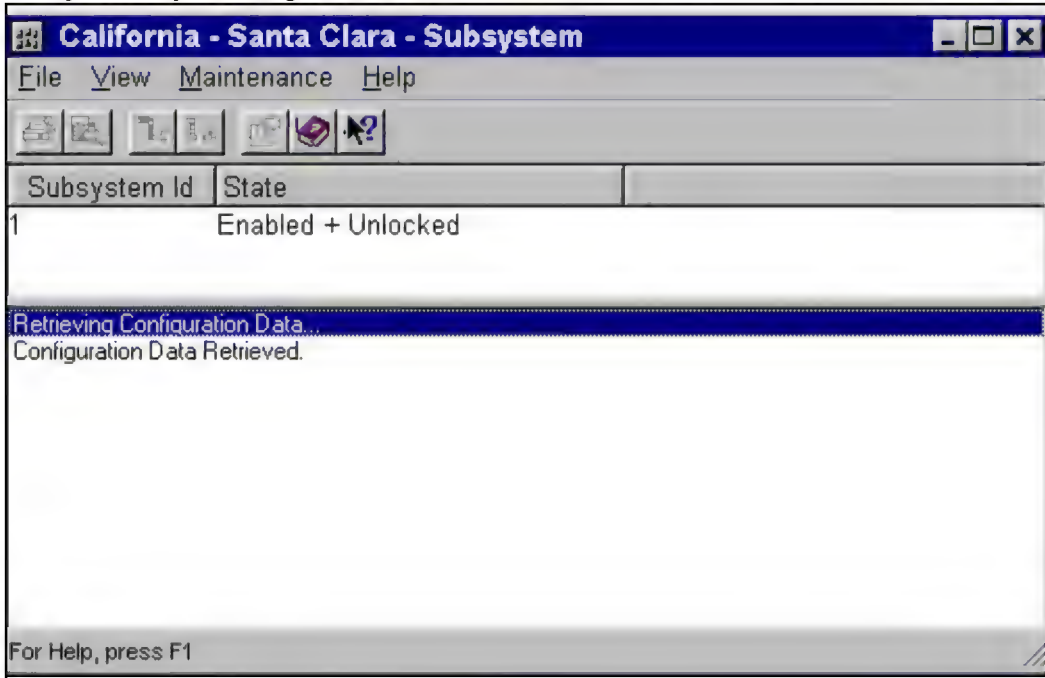
Configuring a Microcellular subsystem

This section describes how to configure a Microcellular subsystem through the Mobility System Management (MSM) application running on a local or remote Meridian Administration Tool (MAT). You connect to a Meridian 1 system through the MSM MAT and configure the Microcellular subsystem.

After you add a Meridian 1 system to an MSM MAT, you can use the Subsystem Object Manager to configure MSPRE properties for the Microcellular system:

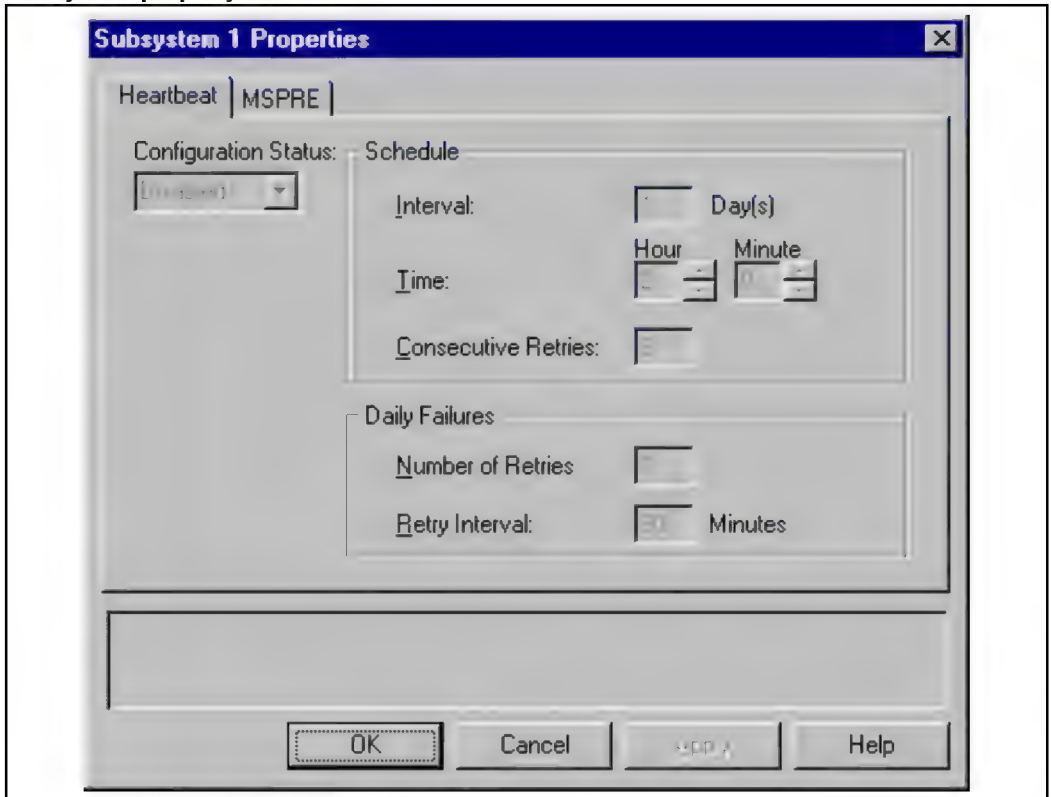
- 1 In the System window, double-click the Subsystem icon to open the Subsystem Object Manager window, which Figure 60 illustrates.

Figure 60
Subsystem Object Manager window



- 2 Choose Properties from the Configuration menu. This opens the Subsystem property sheet, which Figure 61 illustrates.

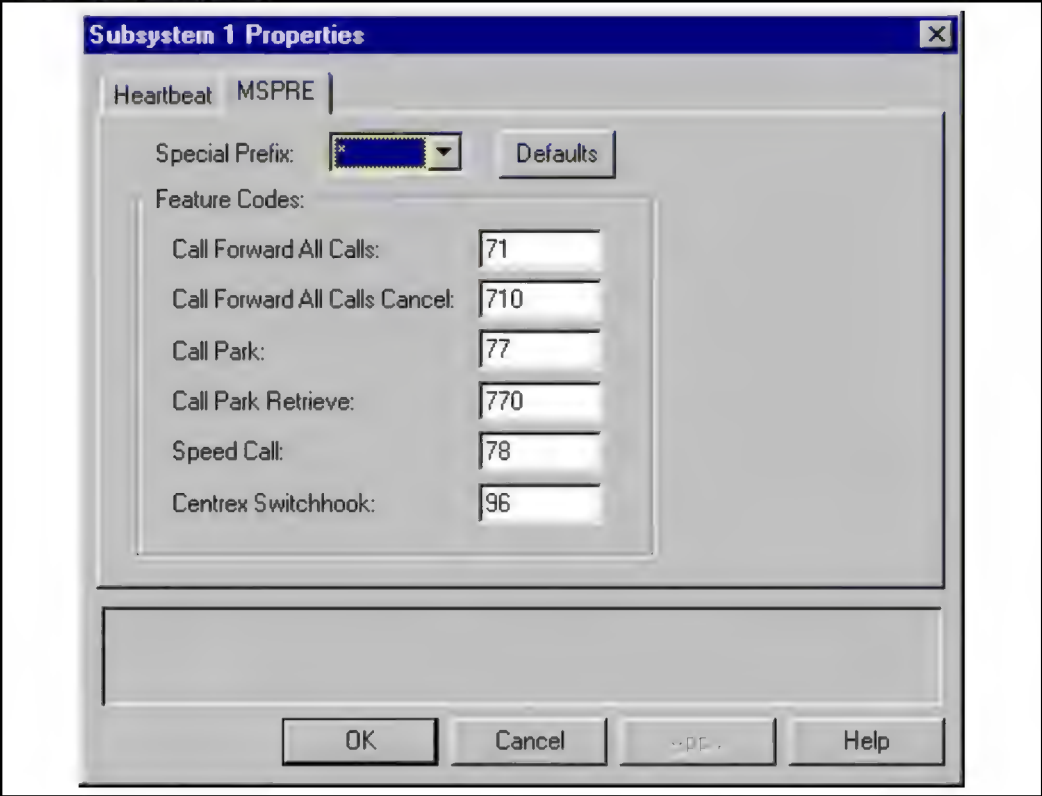
Figure 61
Subsystem property sheet



The Heartbeat property page shows the attribute values for the heartbeat that the CMCP sends to the Microcellular system. You cannot change the attribute values on this page. For more information about the CMCP heartbeat, see “Configuring heartbeat parameters” on page 383.

- 3 Click the MSPRE tab to view the MSPRE property page, which Figure 62 illustrates.

Figure 62
MSPRE property page



4 Enter the MSPRE attribute values for the Microcellular system:

Special Prefix The character that must precede all feature activation/deactivation codes.

Values: *, #, 1-9, None

Default value: *

Call Forward All Calls Call Forward activation code, up to four digits long.

Default value: 71

Call Forward All Calls Cancel Call Forward activation code, up to four digits long.

Default value: 710

Call Park Call Park activation code, up to four digits long.

Default value: 77

Call Park Retrieve Call Park Retrieve code, up to four digits long.

Default value: 770

Speed Call Speed Call code, up to four digits long.

Default value: 78

Centrex Switchhook Centrex Switchhook code, up to four digits long.

Default value: 96

To restore the default values at any time, click Defaults.

5 Click OK to enter the MSPRE attribute values and return to the Subsystem Object Manager window.

If you need to change an MSPRE attribute value, you can highlight the Microcellular system in the subsystem list box and choose Properties from the File menu to open the property sheet again. Button 2 on the mouse also opens the property sheet.

Configuring EIMCs

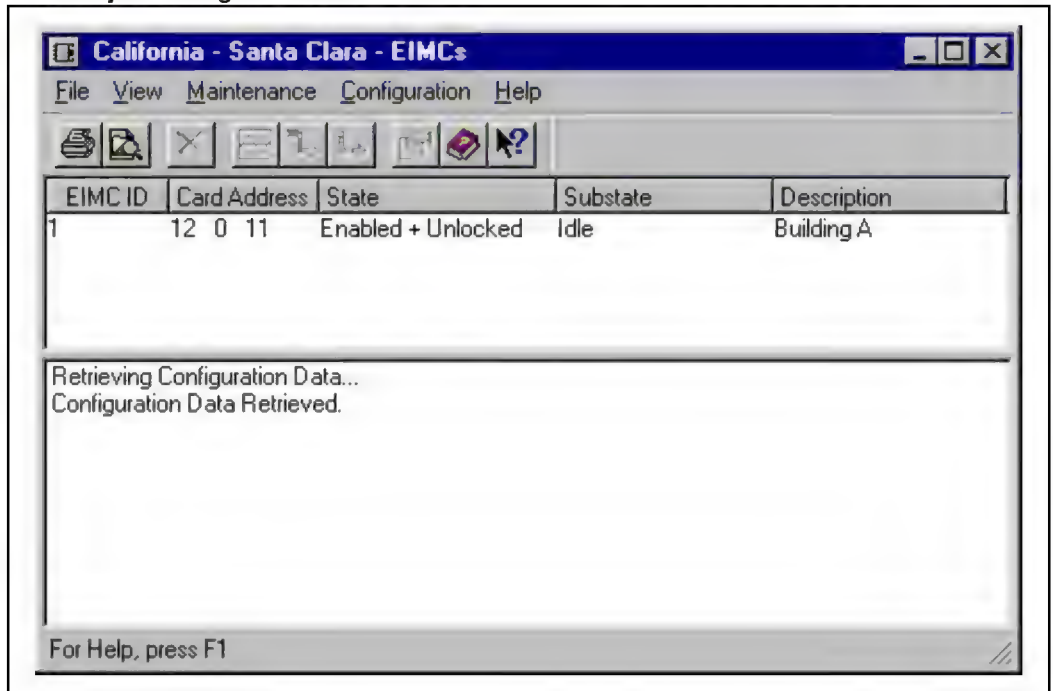
Use the EIMC Object Manager to configure EIMC objects. Before you can add an EIMC, the Meridian 1 system must have an MISP configured for the Microcellular system. After you add an EIMC, it appears in the object manager window, which lists all the EIMCs and provides access to the EIMC property sheet.

Note: If the EIMC is not installed on the Meridian 1 system, you need to install the card first. For installation instructions, see “Embedded Intelligent Mobility Controller (EIMC) card” on page 176.

To add and configure an EIMC, perform the following procedure:

- 1 In the System window, double-click the EIMCs icon to open the EIMC Object Manager window, which Figure 63 illustrates.

Figure 63
EIMC Object Manager window



- 2 Choose Add EIMC from the Configuration menu. The object manager adds an EIMC object and opens the EIMC property sheet.
- 3 Enter the attribute values for the EIMC object.

Figure 64 illustrates the EIMC property sheet for Option 51C, 61C, 81, and 81C systems.

Figure 64
EIMC property sheet for Options 51C, 61C, 81, and 81C

EIMC 1 Properties

Configuration

MISP ID:

Description:

Card address:

OK Cancel < Back Help

For Option 51C, 61C, 81, or 81C, configure the EIMC with the following values:

- | | |
|--------------|---|
| Description | Up to 30 alphanumeric characters that describe the EIMC.
Example: Eimc 1, Buildings A/B/C |
| Card Address | Numeric characters that specify the loop (0-156), shelf (0-1), and IPE card slot (0-15) where the EIMC resides.
Example: 12 0 11 |

Figure 65 illustrates the EIMC property sheet for Option 11C systems.

Figure 65
EIMC property sheet for Option 11C

The screenshot shows a Windows-style dialog box titled "EIMC 1 Properties" with a close button (X) in the top right corner. The "Configuration" tab is selected. Inside the dialog, there are two labeled text input fields: "Description" with the text "Building A" and "Card address" with the text "5". The "Card address" field also has the word "Slot" written above it. At the bottom of the dialog, there are four buttons: "OK", "Cancel", "Apply", and "Help".

For Option 11C, configure the EIMC with the following values:

Description Up to 30 alphanumeric characters that describe the EIMC.
Example: 51b

Card Address Numeric characters that specify the card slot (1-10) in which the EIMC resides in the main cabinet.
Example: 4

- 4 Click OK to save the EIMC attribute values and return to the EIMC Object Manager window.

The object manager list box displays information about all the EIMCs in the Microcellular system, including the attribute values. If you need to change an attribute value for an EIMC, you can highlight the EIMC in the list box and choose Properties from the File menu to open the property sheet again. Button 2 on the mouse also opens the property sheet.

Configuring MXCs

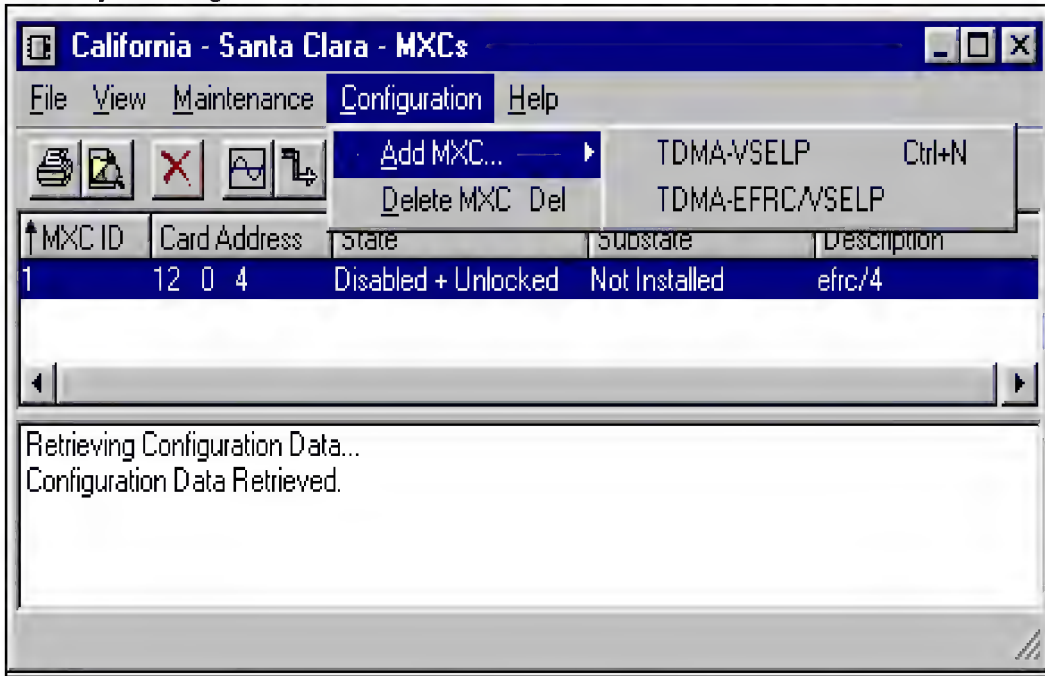
Use the MXC Object Manager to add and configure MXC objects. Before you can add an MXC, the Microcellular system must have a parent EIMC object for the MXC. After you add an MXC, it appears in the object manager window, which lists all the cells and provides access to the MXC property sheet.

Note: If the MXC is not installed on the Meridian 1 system, you need to install the card first. For installation instructions, see “Microcellular Transcoder (MXC) cards” on page 176.

To add and configure an MXC object, perform the following procedure:

- 1 In the System window, double-click the MXCs icon to open the MXC Object Manager window, which Figure 66 illustrates.

Figure 66
MXC Object Manager window



- 2 Choose Add MXC from the Configuration menu, selecting either ACELP service (TDMA-EFRC/VSELP) or VSELP only service (TDMA-VSELP).

The object manager adds an MXC object and opens the MXC property sheet.

Note: To determine which kind of service to select for each MXC, check the site planning documents. If you select ACELP service, the MXC can support a maximum of one control-channel radio and three traffic-channel radios, in one or more MBSSs, with toll-line digital voice quality. If you select VSELP only service, the MXC can support a maximum of one control-channel radio and seven traffic-channel radios.

- 3 Enter the attribute values for the MXC object. Figure 67 illustrates the MXC property sheet for Option 51C, 61C, 81, and 81C systems.

Figure 67
MXC property sheet for Options 51C, 61C, 81, and 81C

The screenshot shows a Windows-style dialog box titled "MXC 1 Properties" with a close button (X) in the top right corner. The "Configuration" tab is selected and highlighted with a dotted border. The dialog contains the following fields and controls:

- EIMC ID:** A text box containing the value "1".
- Description:** A text box containing the value "efrc/4".
- Card address:** A group box containing three sub-fields:
 - Loop:** A text box containing the value "12".
 - Shelf:** A text box containing the value "0".
 - Card:** A text box containing the value "4".
- Transcoder mode:** A dropdown menu with "Transcoder Mode" selected.

At the bottom of the dialog, there are four buttons: "OK", "Cancel", "Apply", and "Help".

For Options 51C-81C, configure the MXC with the following values:

- | | |
|--------------|---|
| EIMC ID | The number of the parent EIMC for the MXC. The Microcellular system numbers the EIMCs in installation order, from 1 to 8.
Example: 1 |
| Description | Up to 30 alphanumeric characters that describe the MXC. Example: Buildings B & C |
| Card Address | Numeric characters that specify the loop (0-156), shelf (0-1), and IPE card slot (0-15) where the MXC resides.
Example: 12 0 4 |

Transcoder mode, a read-only field on the MXC Configuration page, specifies whether the MXC provides both ACELP and VSELP service (TDMA-EFRC/VSELP) or VSELP only service (TDMA-VSELP).

Figure 68 illustrates the MXC property sheet for Option 11C systems.

Figure 68
MXC property sheet for Option 11C

MXC 1 Properties

Configuration

EIMC ID: 1

Description: vselp

Slot
Card address: 0

Transcoder mode: COMB-OUT

OK Cancel Help

For Option 11C, configure the MXC with the following values:

EIMC ID	The number of the parent EIMC for the MXC. The Microcellular system numbers the EIMCs in installation order, from 1 to 8. Example: 2
Description	Up to 30 alphanumeric characters that describe the MXC. Example: MXC for MBS 2
Card Address	Numeric characters that specify the card slot (1-30) where the MXC resides in the main or expansion cabinet. Example: 5

Transcoder mode, a read-only field on the MXC Configuration page, specifies whether the MXC provides both ACELP and VSELP service (TDMA-EFRC/VSELP) or VSELP only service (TDMA-VSELP).

- 4 Click OK to save the MXC attribute values and return to the MXC Object Manager window.

The object manager list box displays information about all the MXCs in the Microcellular system, including the attribute values. If you need to change an attribute value for an MXC, you can highlight the MXC in the list box and choose Properties from the File menu to open the property sheet again. Button 2 on the mouse also opens the property sheet.

Configuring zones

A zone is a logical Microcellular component that represents a geographic coverage area consisting of one or more cells.

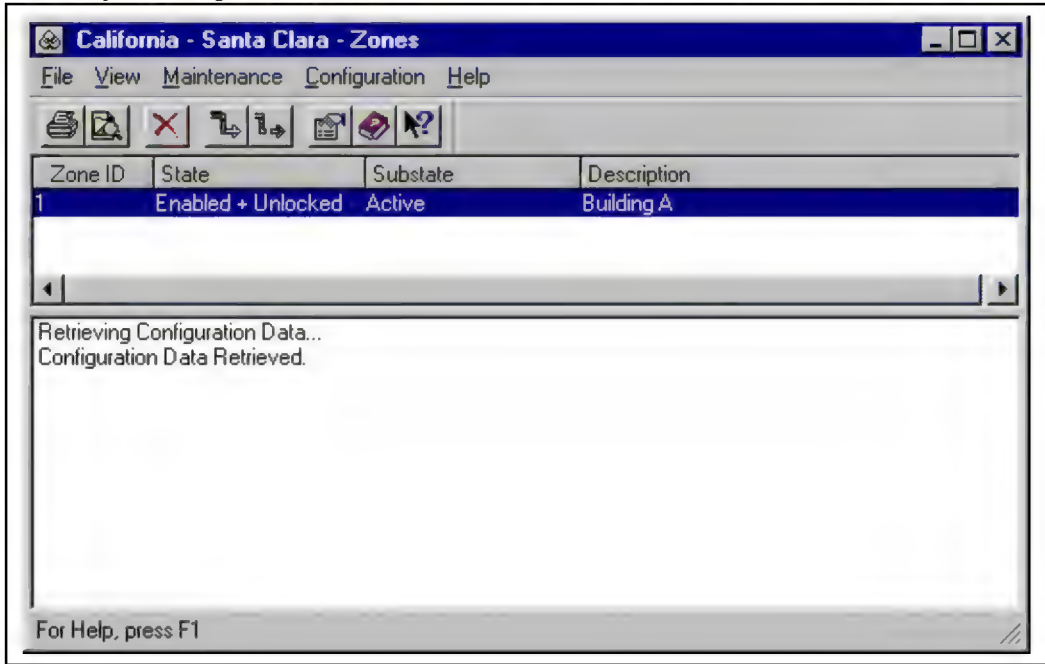
Use the Zone Object Manager to add and configure zone objects. Before you can add a zone, the Microcellular system must have a parent EIMC object for the zone. After you add a zone, it appears in the object manager window, which lists all the zones and provides access to the zone property sheet.

You can enter only part of the zone configuration, which the cellular operator completes. When the configuration is complete, you can unlock the zone.

To add and configure a zone object, perform the following procedure:

- 1 In the System window, double-click the Zones icon to open the Zone Object Manager window, which Figure 69 illustrates.

Figure 69
Zone Object Manager window



- 2 Choose Add Zone from the Configuration menu. The object manager adds a zone object and opens the Zone property sheet.

Figure 70 illustrates the Zone property sheet for the IS-136 protocol.

Figure 70
IS-136 Zone property sheet

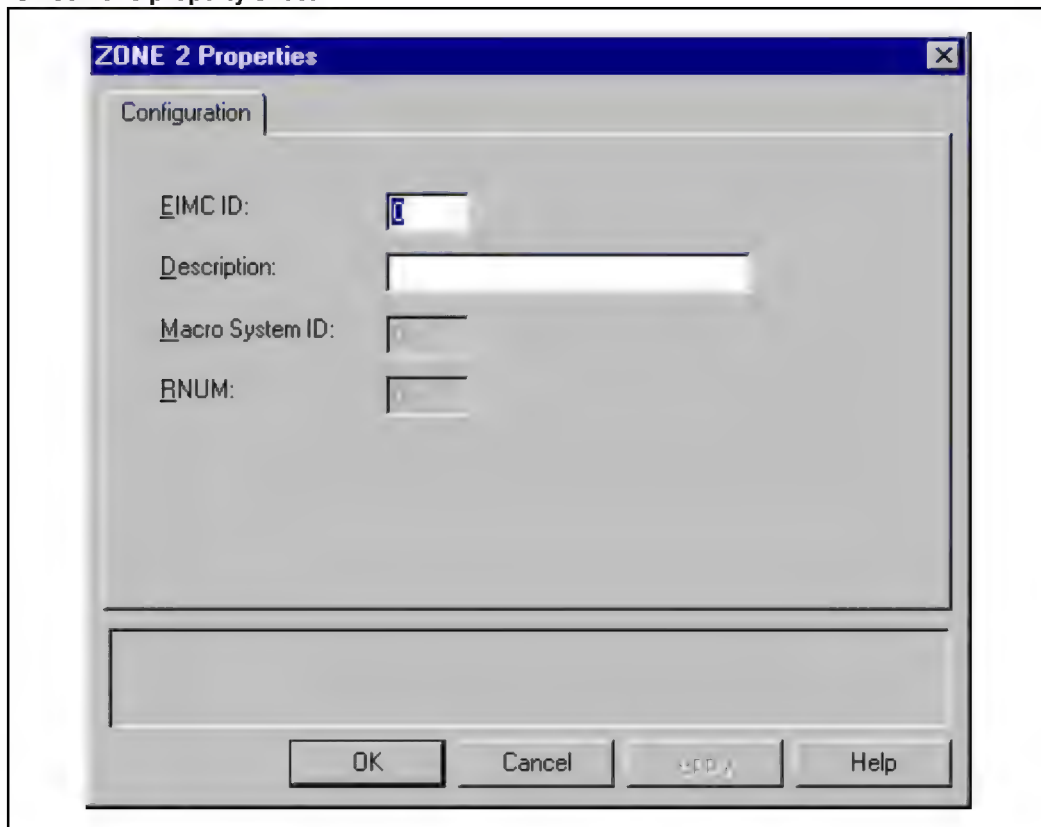
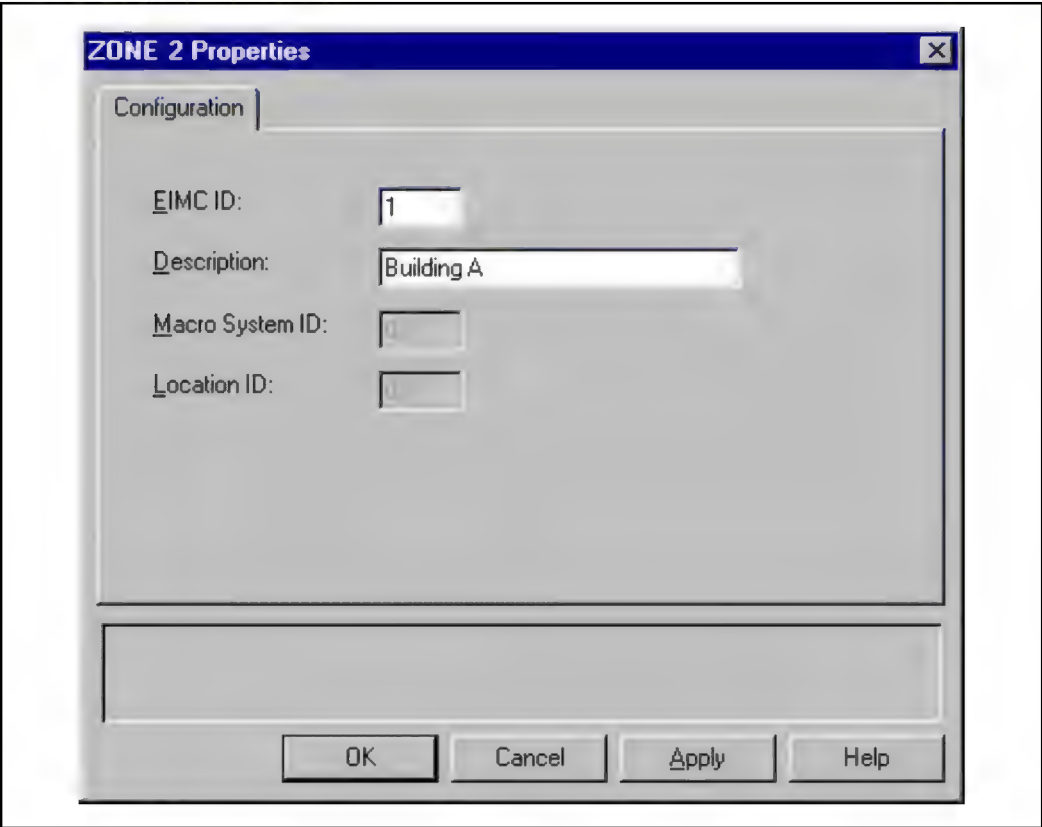


Figure 71 illustrates the Zone property sheet for the IS-54B protocol.

Figure 71
IS-54B Zone property sheet



3 Configure the zone with the following values:

- | | |
|-------------|--|
| EIMC ID | The number of the parent EIMC for the zone. The Microcellular system numbers the EIMCs in installation order, from 1 to 8.
Example: 1 |
| Description | Up to 30 alphanumeric characters that describe the physical location covered by the zone.
Example: Buildings A/B/C |

The cellular operator configures the Macro System ID, RNUM, and Location ID (IS-54B) attribute values, as “Cellco Mobility Control Point (CMCP)” on page 293 describes.

4 Click OK to enter the zone attribute values and return to the Zone Object Manager window.

The object manager list box displays information about all the zones in the Microcellular system, including the attribute values. If you need to change an attribute value for a zone, you can highlight the zone in the list box and choose Properties from the File menu to open the property sheet again. Button 2 on the mouse also opens the property sheet.

Configuring cells

Use the Cell Object Manager to add and configure cell objects. Before you can add a cell, the Microcellular system must have a parent zone object for the cell. After you add a cell, it appears in the object manager window, which lists all the cells and provides access to the Cell property sheet and pages.

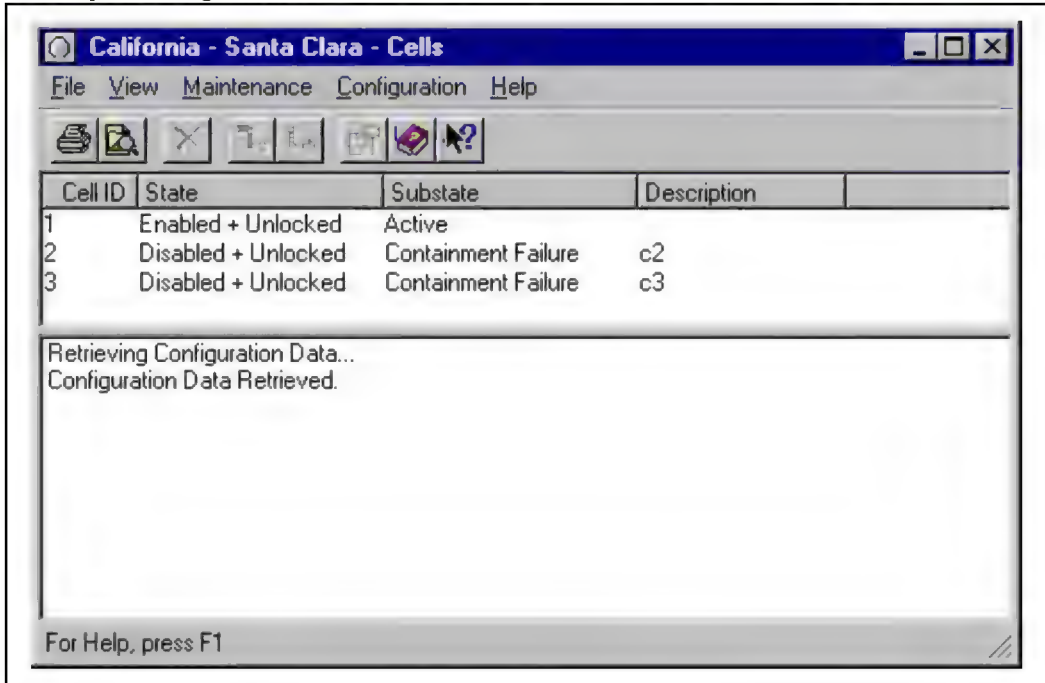
You can enter only part of the cell configuration, which the cellular operator completes. For information about the parameters that the cellular operator enters, see “Completing cell configurations” on page 350.

For information about unlocking a cell, see “Unlocking cards, zones, cells, and radios” on page 249.

To add and configure a cell object, perform the following procedure:

- 1 In the System window, double-click the Cells icon to open the Cell Object Manager window, which Figure 72 illustrates.

Figure 72
Cell Object Manager window



- 2 Choose Add Cell from the Configuration menu. The object manager adds a cell object and opens the Cell property sheet.

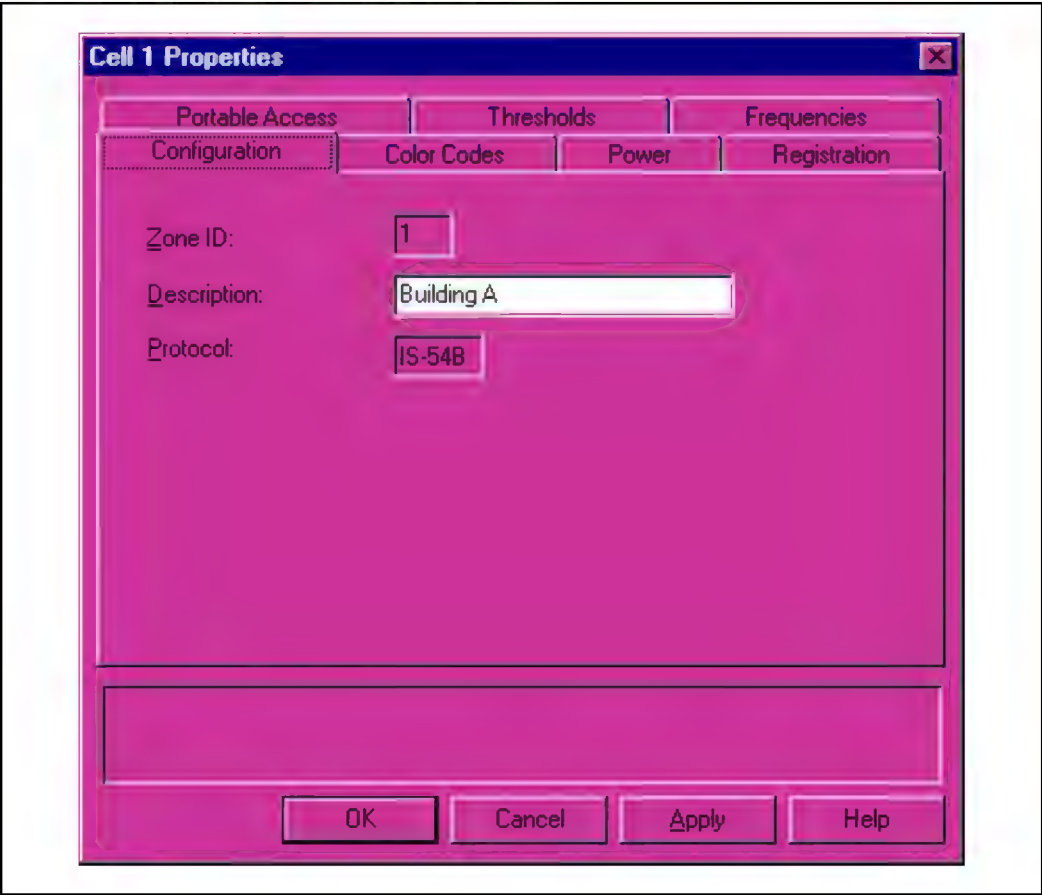
Figure 73 illustrates the Cell property sheet for the IS-136 protocol.

Figure 73
IS-136 Cell property sheet, Configuration page

The screenshot shows a Windows-style dialog box titled "Cell 1 Properties" with a close button (X) in the top right corner. The dialog has four tabs: "Portable Access", "Thresholds", "Frequencies", and "Configuration". The "Configuration" tab is selected and active. Inside this tab, there are four sub-tabs: "Configuration", "Color Codes", "Power", and "Registration". The "Configuration" sub-tab is selected. The main area of the dialog contains several labeled input fields: "Zone ID:" with a text box containing the number "1"; "Description:" with an empty text box; "Protocol:" with a dropdown menu showing "IS-136"; "System operator code:" with a text box containing "1"; "PSID:" with a text box containing "123456"; and "AlphaPSID:" with an empty text box. At the bottom of the dialog, there are four buttons: "OK", "Cancel", "Apply", and "Help".

Figure 74 illustrates the Cell property sheet for the IS-54B protocol.

Figure 74
IS-54B Cell property sheet, Configuration page



- 3** Enter the Configuration attribute values for the cell on the Cell property sheet Configuration page:

Zone ID	The numeric ID of the parent zone for the cell. The Microcellular system numbers zones in the order in which zone objects are added, from 1 to 8. CTS name: zone (prefixed with Z) Example: 1
Description	Up to 30 alphanumeric characters that describe the cell. Example: Cell 1

Click Apply to save the Configuration attribute values

The cellular operator configures the System operator code, PSID, and Alpha PSID attribute values, as “Completing cell configurations” on page 350 describes. The System operator code, PSID, and Alpha PSID apply only to an IS-136 cell and do not appear on the Configuration page for an IS-54B cell.

The cellular operator also configures the Color Codes, Power, Registration, Portable Access, Thresholds, and Frequencies property pages as well as external cells and neighbor cells.

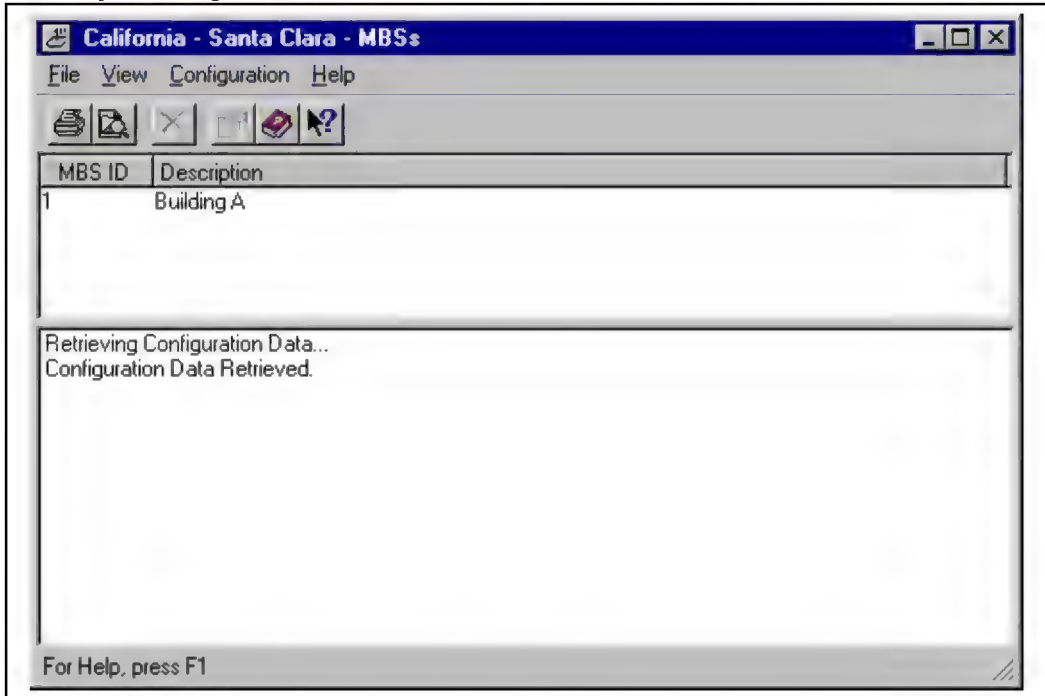
Configuring Microcellular Base Stations

Use the MBS Object Manager to add and configure MBS objects. Before you can add an MBS, the Microcellular system must have a parent cell object and MXC object for the MBS. After you add an MBS, it appears in the object manager window, which lists all the cells and provides access to the MBS property sheet.

To add and configure an MBS object, perform the following procedure:

- 1 In the System window, double-click the MBSs icon to open the MBS Object Manager window, which Figure 75 illustrates.

Figure 75
MBS Object Manager window



- 2 Choose Add MBS from the Configuration menu. The object manager adds an MBS object and opens the MBS property sheet, which Figure 76 illustrates.

Figure 76
MBS property sheet

The screenshot shows a Windows-style dialog box titled "MBS 1 Properties" with a close button (X) in the top right corner. The dialog has a tab labeled "Configuration". Inside the dialog, there are three labeled input fields: "MXC ID:" with a text box containing the number "1", "Cell ID:" with a text box containing the number "1", and "Description:" with a text box containing the text "Building A". Below these fields is a large, empty rectangular area. At the bottom of the dialog, there are four buttons: "OK", "Cancel", "Apply", and "Help".

3 Enter the attribute values for the MBS object:

MXC ID	The number of the parent MXC for the MBS. The Microcellular system numbers the MXCs in installation order, from 1 to 15. Example: 1
Cell ID	The number of the parent cell for the MBS. The Microcellular system numbers the cells in installation order, beginning with 1. Example: 1
Description	Up to 30 alphanumeric characters that describe the MBS. Example: Building C.

4 Click OK to enter the MBS attribute values and return to the MBS Object Manager window.

The object manager list box displays information about all the MBSs in the Microcellular system, including the attribute values. If you need to change an attribute value for an MBS, you can highlight the MBS in the list box and choose Properties from the File menu to open the property sheet again. Button 2 on the mouse also opens the property sheet.

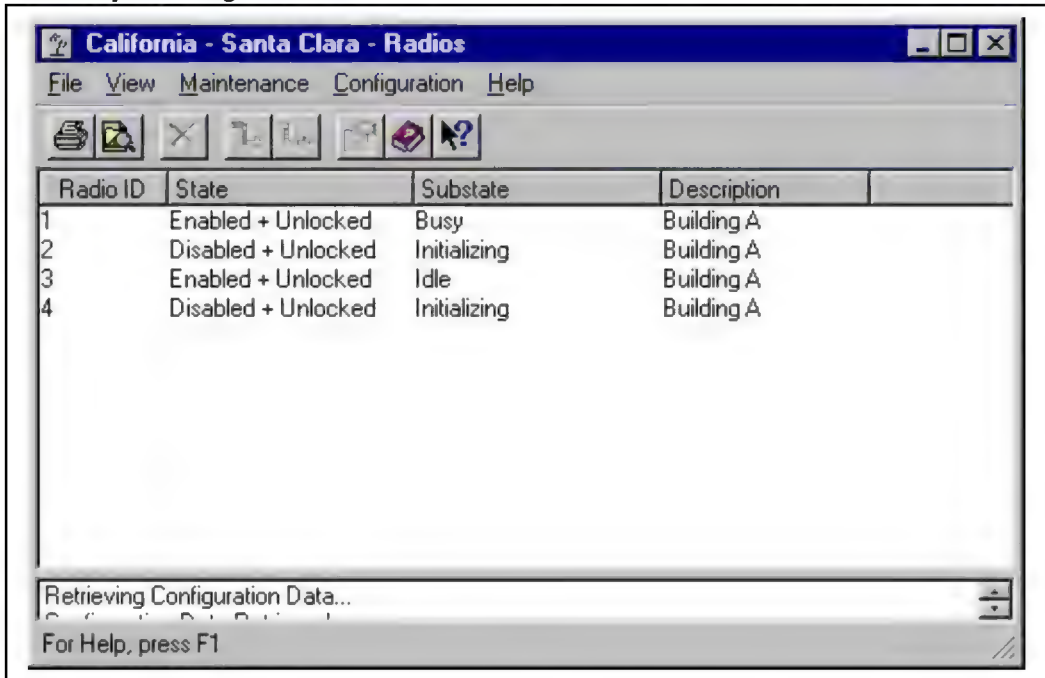
Configuring radios

Use the Radio Object Manager to add and configure radio objects (TRU-IIs). Before you can add a radio, the Microcellular system must have a parent cell object for the radio. After you add a radio, it appears in the object manager window, which lists all the radios and provides access to the radio property sheet.

To add and configure the radio objects for a cell, perform the following procedure:

- 1 In the System window, double-click the Radios icon to open the Radio Object Manager window, which Figure 77 illustrates.

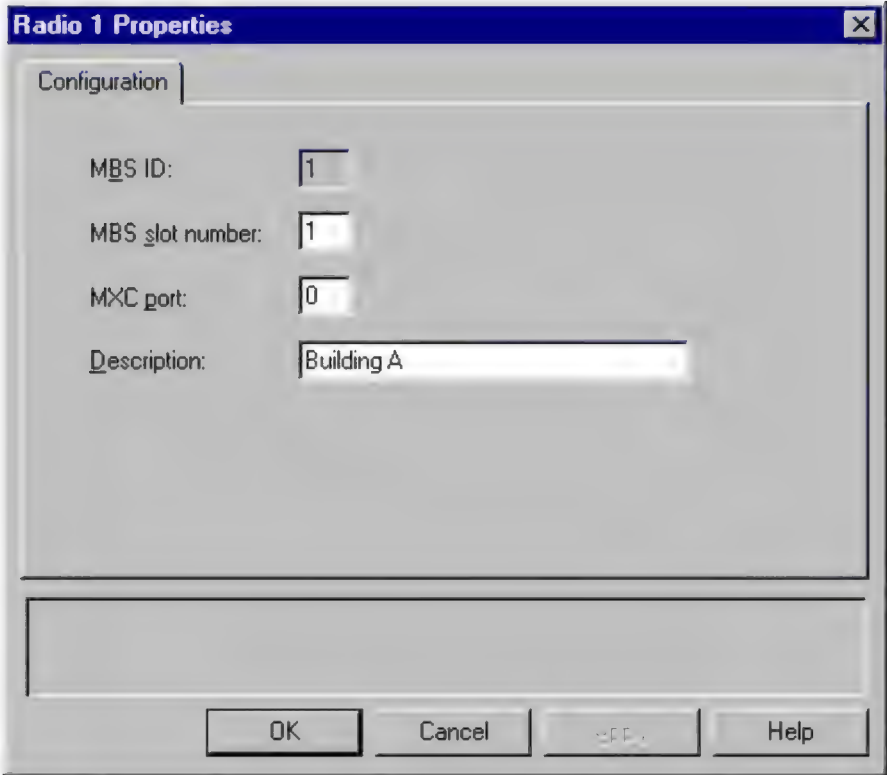
Figure 77
Radio Object Manager window



- 2 Choose Add Radio from the Configuration menu a radio.

The object manager adds a Radio object and opens the radio property sheet, which Figure 78 illustrates.

Figure 78
Radio property sheet



The image shows a Windows-style dialog box titled "Radio 1 Properties" with a close button (X) in the top right corner. The dialog has a tabbed interface with the "Configuration" tab selected. Inside the tab, there are four labeled input fields: "MBS ID:" with a text box containing "1", "MBS_slot number:" with a text box containing "1", "MXC port:" with a text box containing "0", and "Description:" with a text box containing "Building A". Below these fields is a large empty rectangular area. At the bottom of the dialog, there are four buttons: "OK", "Cancel", "Apply", and "Help".

Field	Value
MBS ID:	1
MBS_slot number:	1
MXC port:	0
Description:	Building A

3 Enter the attribute values for the radio object:

MBS ID The number of the parent MBS for the radio. The Microcellular system numbers the MBSs in installation order, beginning with 1.

Example: 1

MBS slot number The MBS slot in which the TRU-II radio resides, from 1 to 4.

Example: 1

MXC port The port on the parent MXC to which the radio is connected, from 0 to 7 (the MXC that is the parent of the radio's parent MBS).

Example: 0

Description Up to 30 alphanumeric characters that describe the radio. Example: Radio 1 - Building C.

4 Click OK to enter the radio attribute values and return to the Radio Object Manager window.

The object manager list box displays information about all the radios in the Microcellular system, including the attribute values. If you need to change an attribute value for a radio, you can highlight the radio in the list box and choose Properties from the File menu to open the property sheet again. Button 2 on the mouse also opens the property sheet.

- 5** Examine the radio that you are testing to verify that it will operate correctly:
- a** Observe the faceplate of the Alarm and Power Supply unit (APS) in the MBS. Only the PSU OK green LED should be on. Any other LED indicates a problem that should be corrected before you continue.
 - b** Make sure that all configured radios for the MBS are locked.
 - c** Insert the TRU-II into a slot in the MBS.
 - d** Observe the LED display. It should show “ROM IDLE” or “RDRUxxxx” (where xxxx is the EPROM version number). The display toggles between the two messages.

The “ROM IDLE” message appears for about one minute and “RDRUxxxx” for about 20 seconds. If the time is shorter (30 seconds or less for ROM IDLE and 10 seconds or less for RDRUxxxx), it indicates a problem with the TRU-II. Replace the unit.

- 6 Test the radio's TCM connectivity to determine whether the TCM connections to the MBS are correct:

- a Make sure that all Microcellular objects are unlocked and idle except for the radios.

Note: Before you unlock a radio, reset the TRU-II to place it in a known state. To reset a TRU-II, remove it from the MBS slot and reinstall it.

- b Monitor the display on the radio you just added while you unlock it from the Radio Object Manager window. To unlock the radio, highlight the radio object in the window and choose Unlock from the Maintenance menu (while someone watches the radio display).
- c Verify that the radio displays the following messages:

The radio display should change from "ROM IDLE to RDRUxxxx" and then to "LAPDINIT" within one minute after you issue the Unlock command.

After "LAPDINIT" is displayed momentarily, "MTCE" is displayed. Then "MTCE IDLE" is displayed.

Failure to display the preceding messages usually indicates that there is a TCM wiring error or that the TRU-II is in an inoperable state.

- d If the messages do not display correctly, lock the radio (Lock on the Maintenance menu) and check for the following problems:

Radio not seated properly. Cycle power to the TRU-II by unplugging the unit, waiting five seconds, and then reinserting it. Then reset the radio and unlock it again through the Radio Object Manager window while monitoring the display.

Radio not connected to right TCM pair. There are four pairs of TCM wires, one pair for each of the four radios. Verify that the TCM wiring to the radios has not been swapped or left unconnected. Fix any wiring problems and then reset the radio and unlock it again through the Radio Object Manager window while monitoring the display.

Radios in the MBS do not unlock correctly. Check to see if the radios in the other slots will unlock with the correct display, after following the procedure for adding, testing, and

unlocking each radio. If the other radios do not unlock correctly, fix any problems with the installation of the MBS. Then reset each radio and unlock it again through the Radio Object Manager window while monitoring the display.

- e If the radio still does not unlock correctly, try a different TRU-II in the slot.

For information on radio installation, see “Installing radio modules” on page 131.

For additional information on radio troubleshooting, see the *Nortel COMPANION Microcellular Operations, administration, and maintenance guide* (553-3611-300).

- 7 Add, test, and unlock the rest of the radios for the cell one at a time to verify connectivity.
- 8 Lock all the radios in the cell by highlighting each radio and choosing Lock from the Maintenance menu.
- 9 With the radios locked, highlight one or two radios and choose Forced Download from the Configuration menu. Repeat for all the radios in the cell. You can download to two radios at a time.

The forced download operation can take up to 1/2 hour per radio, sequentially. The State and Substate columns in the object manager list box show the status of the download operation.

- 10 Reset all the radios by removing the TRU-IIs from the MBS slots and then reinstalling them.

This puts the radios in a known state for the final unlocking. For information about unlocking the radios during system initialization, see “Initializing a Microcellular system” on page 247.

Configuring the AFP region and Stations

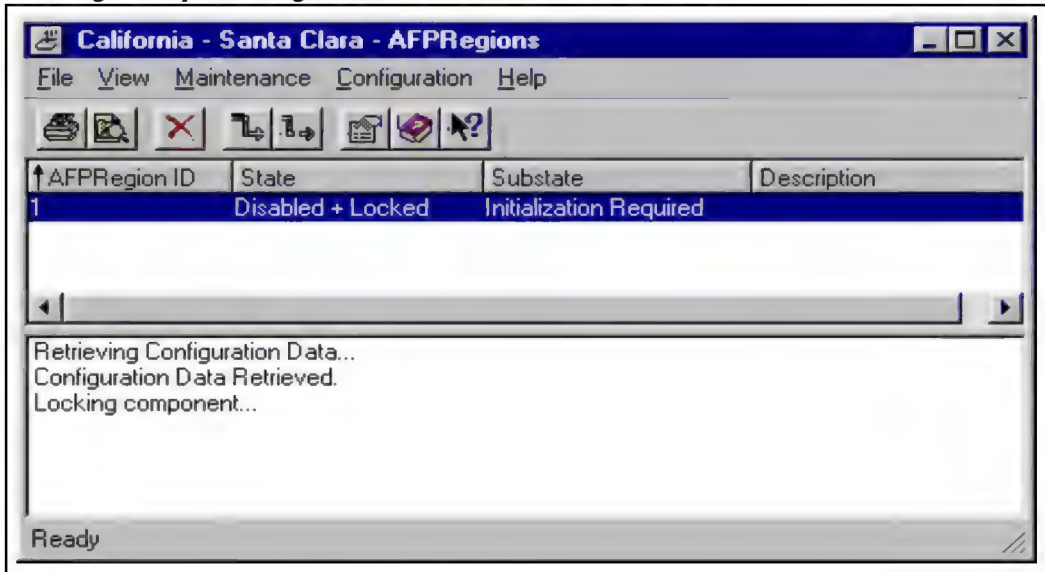
Use the AFP Region Object Manager to configure the AFP region and to add and configure AFP Station objects. The AFP region, a logical Microcellular component, appears in the object manager window, which provides access to the AFPRegion property sheet and pages.

You can enter only part of the AFP region configuration, which the cellular operator completes. For information about completing region configuration, see “Configuring AFP Region” on page 365.

To add and configure one or more AFP Stations, perform the following procedure:

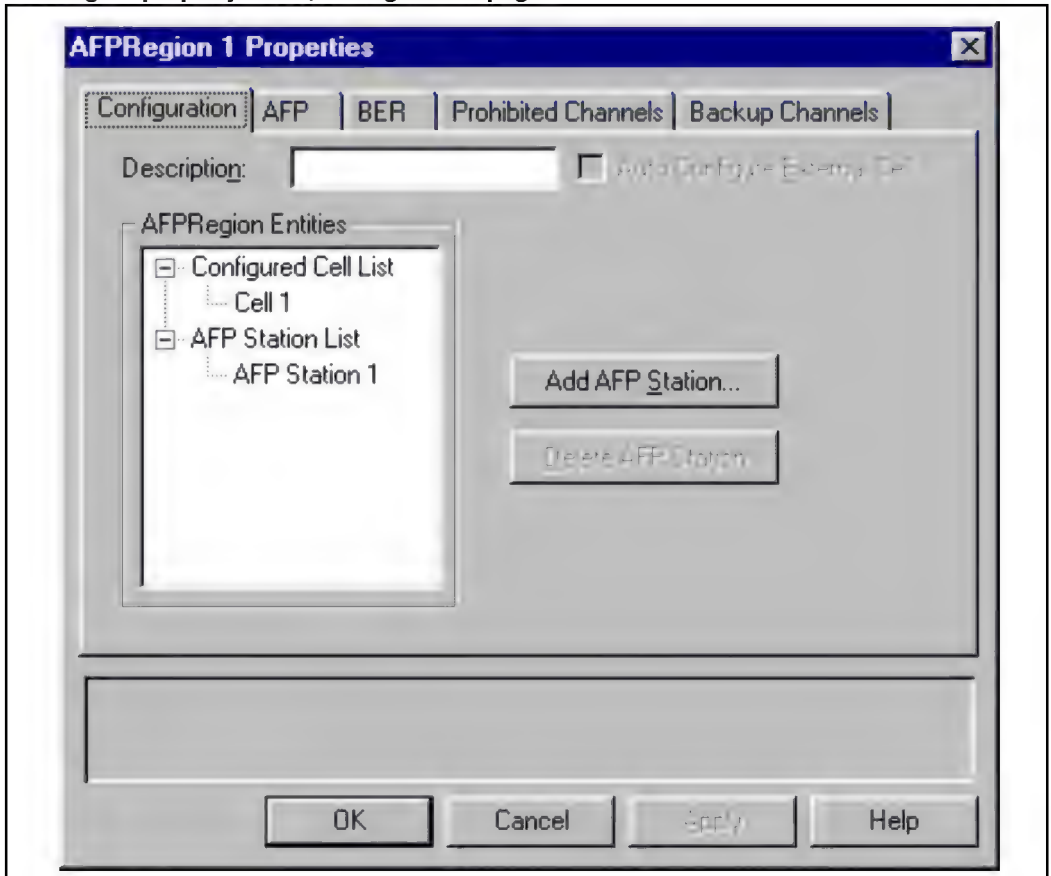
- 1 In the System window, double-click the AFPRegions icon to open the AFP Region Object Manager window, which Figure 79 illustrates.

Figure 79
AFP Region Object Manager window



- 2 From the File menu, choose Properties, or click the right mouse button and choose Properties. The object manager opens the AFPRegion property sheet, which Figure 80 illustrates.

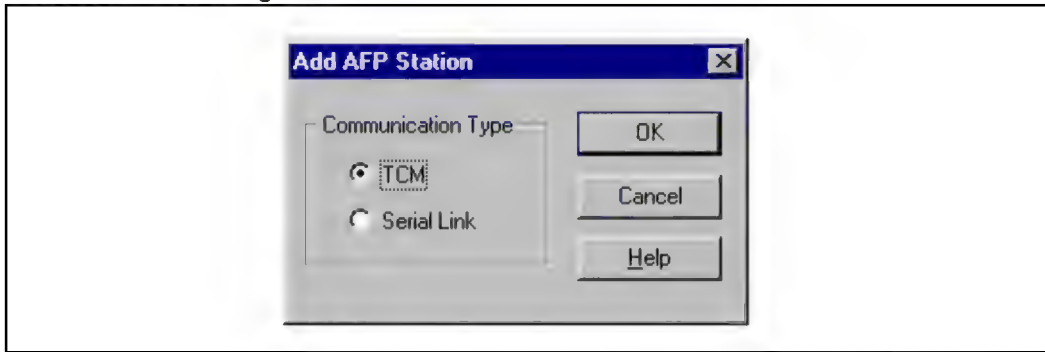
Figure 80
AFPRegion property sheet, Configuration page



3 Configure one or more AFP Stations for the region.

To add an AFP Station object to the Microcellular software, click the Add AFP Station button. The Add AFP Station dialog box appears, as Figure 81 illustrates.

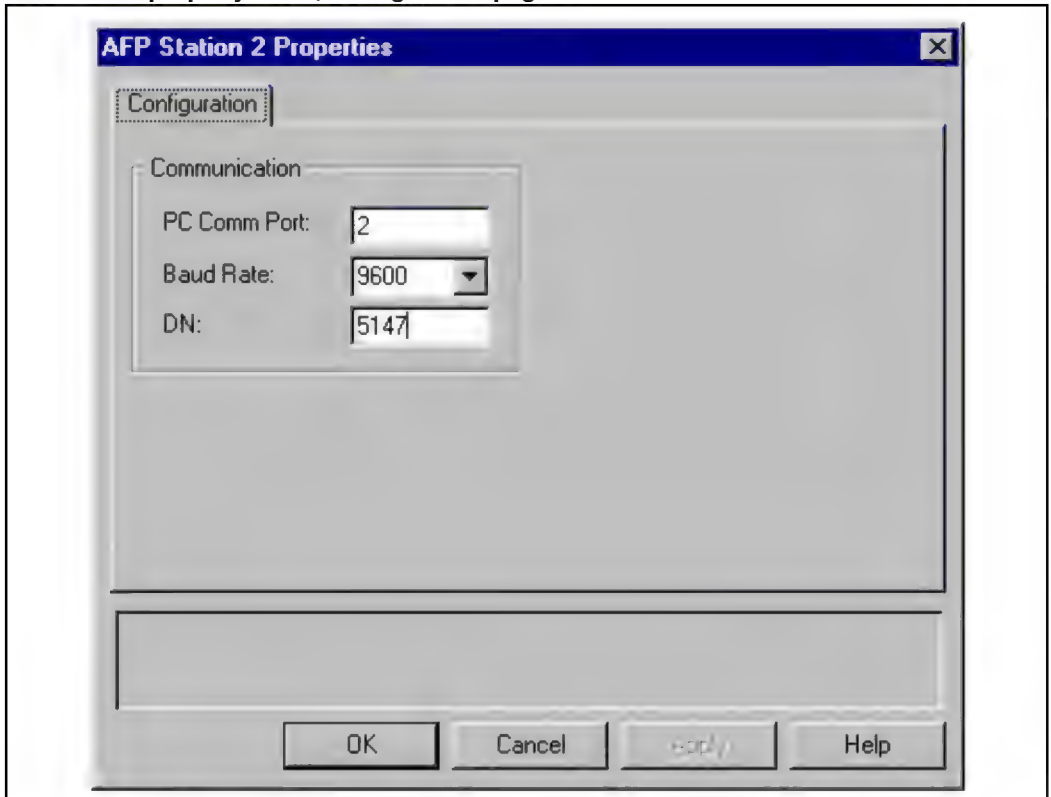
Figure 81
Add AFP Station dialog box



- 4 Select the type of communications link between the AFP station and the MSM MAT. If the AFP station connects to the MAT through TCM cable and a Meridian Communications Unit, click TCM. If the AFP station connects through short-haul modems and telephone cable, click Serial Link. Then click OK.

The object manager adds an AFP Station object and opens the AFP Station property sheet, which Figure 82 illustrates. Configure the AFP station on this property sheet.

Figure 82
AFP Station property sheet, Configuration page



For a TCM connection between an AFP Station and the local MSM MAT, specify values for the following attributes:

- | | |
|---------------------|---|
| PC Comm Port | The PC serial communications port on the local MAT, from 1 to 7, through which AFP software communicates with AFP Stations.
Default value: 2 |
| Baud Rate | The data rate at which AFP software communicates with AFP Stations.
Default value: 9600 |
| DN | The directory number of the DLC port to which the AFP Station connects on the Meridian 1 system. |

For a serial connection between an AFP Station and the local MSM MAT, specify values for the following attributes:

- | | |
|--------------|---|
| PC Comm Port | The PC serial communications port on the local MAT, from 1 to 7, through which AFP software communicates with AFP Stations.
Default value: 2 |
| Baud Rate | The data rate at which AFP software communicates with AFP Stations.
Default value: 9600 |

The cellular operator configures the AFP and Prohibited Channels property pages.

Deleting objects from MSM

During the configuration process, you might need to delete a Microcellular component through the object manager and reconfigure the component again.

Before you can delete an object, you need to delete any child objects from MSM. If you are replacing the parent object, you can add the child objects back after the replacement. For information about parent and child objects, see “Configuring Microcellular components” on page 179.

To delete a Microcellular object from MSM, perform the following procedure on the MSM MAT:

- 1** Open the object manager from the System window by double clicking the icon for the type of object.
- 2** Lock the object by highlighting it in the object list and choosing Lock from the Maintenance menu.
- 3** Choose Delete from the object manager Configuration menu.

For example, to delete a radio object so that you can replace the corresponding TRU-II in an MBS slot, open the Radio Object Manager. In the Radio Object Manager window, select the radio object, lock it, and then choose Delete from the Configuration menu.

The object manager displays a confirmation dialog so that you can cancel the command if you want to. If the object manager cannot delete an object, perhaps because it is currently referenced by another object, the object manager displays an error message.

For more information parent and child objects and about deleting objects, see the *Nortel COMPANION Microcellular Operations, administration, and maintenance guide* (553-3611-300).

Initializing a Microcellular system

This section describes how to initialize a Microcellular system through MSM after configuration of the Microcellular components. To initialize a system, you unlock the AFP region object and any locked Microcellular components. Initialization is complete when the system reaches AFP convergence.

The method of initialization depends on how the voice channels and control channels are assigned:

- If AFP assigns the initial voice channels and control channels, you need to unlock the AFP region object first, wait for AFP convergence, and then unlock the rest of the Microcellular objects before using the system.
- If the cellular operator seeds the initial voice channels and control channels, you can unlock the Microcellular components and use the system before AFP reaches convergence.

The AFP Stations reach convergence when AFP finishes compiling a list of usable backup channels.

After you initialize the Microcellular system, it should be ready for portable registration and for verification of the installation.

Requesting CMCP download and component configuration

When you finish the MSM part of the Microcellular component configuration, ask the cellular operator to configure the rest of the values for the zones, cells, and AFP region. These values include the radio frequencies for the control channel and voice channels in each cell as well as other cellular operating parameters. The cellular operator also configures neighbor cells and external cells.

For more information about what the cellular operator configures, see “Cellco Mobility Control Point (CMCP)” on page 293.

Unlocking the AFP region

After the cellular operator completes the configuration of the Microcellular components, you need to unlock the AFP region. On the local MSM MAT, perform the following steps:

- 1** If AFP is to assign the initial voice channels and control channels automatically, make sure that all of the Microcellular components are locked before you unlock the AFP region.

To check whether components are locked, open each object manager window by double-clicking the object icon in the MAT System window for the Meridian 1 system that includes the Microcellular system.

The State column in the object manager window displays either Locked or Unlocked. If a component is unlocked, highlight the component in the object manager window and choose Lock from the Maintenance menu.

- 2** In the MAT System window, double-click the AFPRegions icon.

MSM opens an AFP Region Object Manager window.

- 3** Highlight the AFP region and choose Unlock from the Maintenance menu.

AFP does a forward and reverse scan of all frequencies not on the prohibited list, which the cellular operator provides, to select a set of replacement frequencies. If this set of frequencies does not change in a configured number of passes (Convergence Pass Threshold parameter), AFP reaches convergence.

AFP convergence takes from two hours to three days, depending on the configuration of the Microcellular system. In the AFP Region Object Manager window, the State and Substate columns for the AFP region display the status of the unlock operation. When the AFP reaches convergence, the Microcellular system unlocks the AFP region and the State and Substate columns display Enabled + Unlocked and Idle. Then you can unlock the Microcellular components.

Unlocking cards, zones, cells, and radios

If AFP assigns channels automatically, you need to wait to unlock the cards, zones, cells, and radios until after AFP reaches convergence. You can unlock the Microcellular objects in the following order, through the MSM object managers:

- 1 Unlock EIMCs (approximately 10 minutes each)
- 2 Unlock MXCs (approximately 10 minutes each)
- 3 Unlock zones (up to 15 minutes each)
- 4 Unlock cells (up to 15 minutes each)
- 5 Unlock radios (approximately 5 minutes each)

Note: Before you unlock the radios, reset the TRU-IIs to place them in a known state. To reset a TRU-II, remove it from the MBS slot and reinstall it.

To open an object manager, double-click its icon in the MAT System window for the Meridian 1 system that includes the Microcellular system.

To unlock objects, perform the following procedure:

- 1 Open the object manager window.
- 2 Highlight each object in the object list and choose Unlock from the Maintenance menu, one object at a time.

Note: When you unlock an object, the state of its parent object or objects must be Enabled + Unlocked.

- 3 Check the status of each object in the object list before you close the object manager window.

Note: If Enabled + Unlocked does not appear in the State column within 15 minutes after you unlock an object, contact the cellular operator for assistance.

Configuring portable telephones

Nortel recommends using the NOKIA 2160 portable telephone, which Nortel has tested in the Microcellular system. You can use other portables that conform to the IS-136 (dual-mode AMPS/TDMA) or IS-54B specifications. Operation of other portables might vary, depending on each portable's feature set.

Before a user can use a portable in the Microcellular system, you need to configure the portable with set features and register the portable to the user, in Station Administration dialog boxes on the MAT. For a list of the features that the Microcellular system supports for portables, see "Meridian 1 system and set features" on page 20.

Portable stations can be configured only on Phantom Loops. Before adding any Portable stations from the MAT, be sure that a Phantom Loop is configured on the Meridian 1 system.

The following guidelines apply to configuring portables:

- The cellular service provider supplies the Mobile Identification Number (MIN) and Electronic Serial Number (ESN) for each portable as well as the System Identification Number (SID) for the portable's home system.

The cellular operator can provide encrypted MINs and ESNs.

The installer initially enters the MIN/ESN table, which the cellular operator can view this table through the CMCP.

- The cellular operator specifies the maximum number of portables for the Microcellular system through the CMCP.
- Only one directory number is supported for each portable.

- Portables cannot share the same multiple appearance DN with BRI terminals. This is an existing limitation of BRI.
- For features that can be invoked by portable users, only the dial access method is supported. For information on which features are supported, see “Portable features” on page 20.
- The actual display of CLID information on each portable is dependent on the characteristics of the portable, such as the physical size of the portable’s display screen and its scrolling capability.
- The Meridian 1 system sends messages to display CLID information on a single line regardless of the number of lines a portable screen has.
- Nortel strongly recommends configuring Call Forward No Answer for all portables so that proper treatment can be given to callers in the event that a portable is turned off or cannot be located. Note that in a multiple appearance case, the Multiple Appearance Redirection Prime (MARP) TN always controls the call redirection for Call Forward No Answer.
- The Meridian 1 Core software provides ringback to the caller of a portable even though the portable might not have been or might never be located. You can change the number of ringing cycles to give sufficient time for the system to locate and radio page the portable before secondary treatment is given.

For example, if at least one appearance of a DN is a portable, you might need to adjust the number of ringing cycles (before Call Forward No Answer) for this DN accordingly for the portable.

Note that when a multiple appearance DN is rung, the number of ringing cycles for CFNA is determined by the Ringing Cycle Option (RCO) value in the Multiple Appearance Redirection Prime (MARP) TN block for that DN. If the DN is a Multiple Appearance DN, the RCO values in the other TN blocks for that DN are ignored.

Configuring portables

To configure each portable, you need to specify its Mobile Identification Number (MIN) and Electronic Serial Number (ESN), the System Identification Number (SID) for the portable’s home system, as Figure 87, “Portable Features dialog box” on page 260 shows. You can obtain this information from the cellular provider.

You can add templates to configure Meridian 1 features for groups of portables and then select a template when you add and configure individual portables. You can also create a Portable station from an existing station, which is useful for copying the configuration from a wireline station to its associated portable. With the MAT Power User Tool, you can choose a forms-based interface instead of the graphical interface for portable configuration.

Adding portable templates

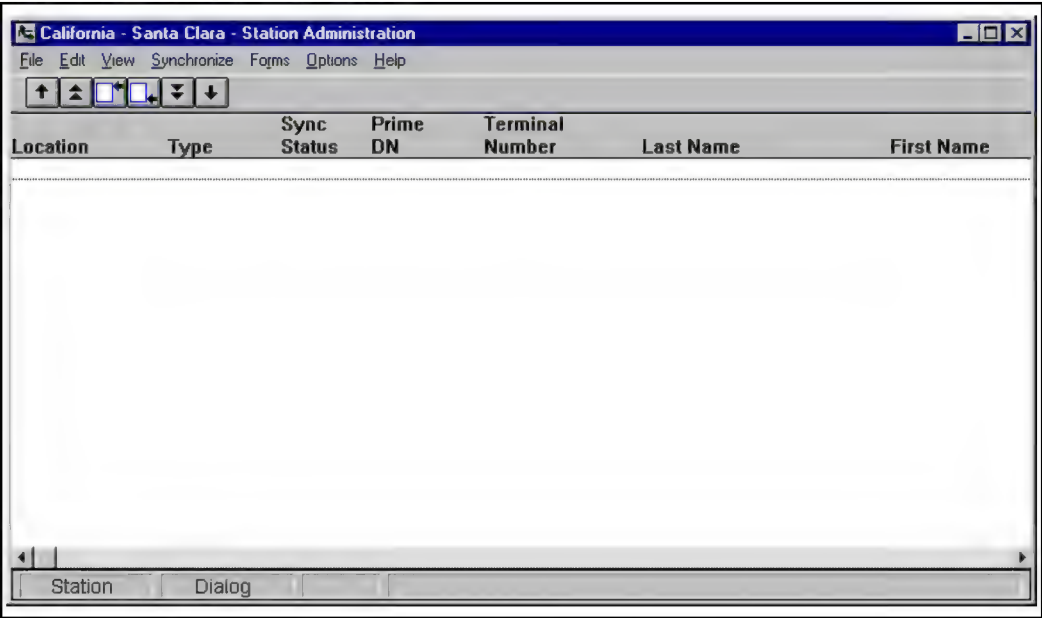
To configure portables with the same or a similar set of Meridian 1 features, you can use a portable template. To add a template for portable configurations, perform the following procedure.

- 1** Double-click the Station Administration icon in the Meridian 1 System window for the Microcellular site.

The MAT Station Configuration window appears, as Figure 83 shows.

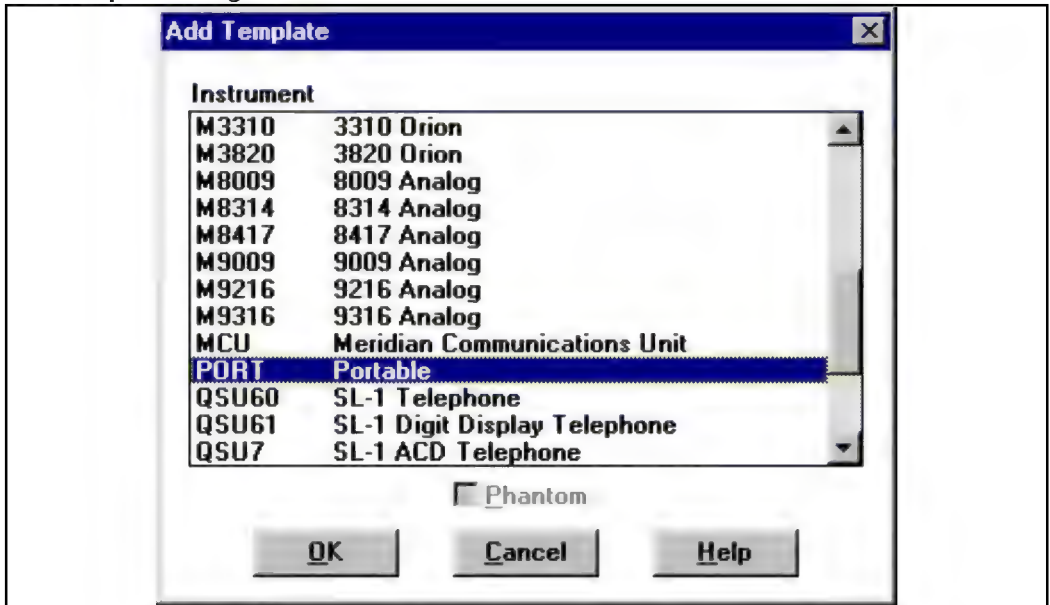
- 2** Choose Template from the View menu to change to the Template view, which displays a list of all the templates already configured for this site, if any.

Figure 83
MAT Station Configuration window



- 3 Choose Add from the Edit menu to open the Add Template dialog box, which Figure 84 shows.

Figure 84
Add Template dialog box



- 4 In the Instrument list box, select the Portable station type (PORT).

This opens the PORTABLE dialog box (Figure 86). Only the keys, features, and classes of service applicable to Portable stations appear in this dialog box.

The Terminal Number field for a Portable station appears disabled (grayed) because you do not need to enter a TN for the template. Instead, the Meridian 1 system automatically assign a Phantom TN to the station when the MAT transmits the station to the Meridian 1. Then the Phantom TN appears in the disabled TN field. You cannot change this field without deleting the station after the Meridian 1 assigns the TN.

Configuring each portable

You can configure each portable for a Microcellular system through the MAT, as follows:

- 1 From the MAT Navigator window, highlight the Meridian 1 system that includes the Microcellular system and issue the Navigator CONNECT command.
- 2 When the login dialog box appears, enter a user ID and password for the Meridian 1 system.

When the MAT establishes a connection to the Meridian 1, the System window appears, like the window in Figure 13 on page 58.

- 3 Double-click the Stations icon and then the Station Administration icon in the Meridian 1 System window.

The MAT Station Configuration window appears (Figure 83 on page 254).

Note: If the Stations icon does not appear in your system window, verify that access to Station Administration was given when the system properties were configured.

- 4 Choose Add from the Edit menu to open the Add Station dialog box, which Figure 85 shows.

Figure 85
Add Station dialog box

Add Station

Number of Stations to Add
1

Customer Number
0

Template

Instrument

M8314	8314 Analog
M8417	8417 Analog
M9009	9009 Analog
M9216	9216 Analog
M9316	9316 Analog
MCU	Meridian Communications Unit
PORT	Portable
QSU60	SL-1 Telephone
QSU61	SL-1 Digit Display Telephone
QSU7	SL-1 ACD Telephone

☐ Automatic Directory Number Assignment

☐ Automatic Terminal Number Assignment

☐ Phantom

☐ Create Portable from Location

OK Cancel Help

In this dialog box, enter or select the following items:

- The number of portables you are configuring, in the Number of Stations to Add box
- A number from the Customer Number choice list

Note: If no numbers appear in the choice list, verify that a customer has been defined in the system properties, under the customer properties. A numbering plan should be associated with the customer information.

- A portable user template from the Template list box

Note: If you are not using a template, add the portable manually by highlighting Portable in the Instrument list and entering all the required fields.

- Other boxes that apply

5 Click OK to get the PORTABLE dialog box, which Figure 86 shows.

Figure 86
PORTABLE dialog box

PORTABLE

Customer 0 **Terminal Number**

Location

Department

Portable Features

0	SCR
0	MCR
1	TRN
2	A03

Set **Clear**

Directory Number

CLID Entry (Numeric or D)

OK
Cancel
Features
Admin..
Validate
Help

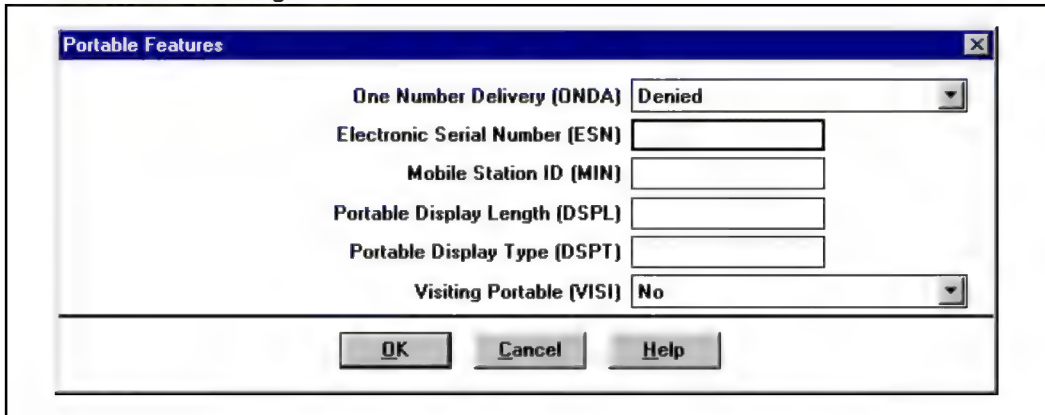
- 6** In the PORTABLE dialog box, enter the following items for each portable:

- First and last name of the portable user
- Customer number
- Location
- Department

You cannot enter the terminal number, which is the number associated with the Phantom Loop that is preprogrammed on the Meridian 1 system. When the Meridian 1 system receives the portable information, it automatically assigns the terminal number.

- 7** Then select the features for the portable to use. Highlighting each feature in the Portable Features list box and click Set. If you make a mistake, highlight the feature again and click Clear.
- 8** Enter the Electronic Serial Number (ESN) and Mobile Identification Number (MIN) of the portable, both provided by the cellular company, and other portable features:
- a** Click Features and search by Feature Group.
 - b** Under Feature Group, select Portable Features, which opens the Portable Features dialog box, which Figure 87 shows.

Figure 87
Portable Features dialog box



Portable Features

One Number Delivery (ONDA)

Electronic Serial Number (ESN)

Mobile Station ID (MIN)

Portable Display Length (DSPL)

Portable Display Type (DSPT)

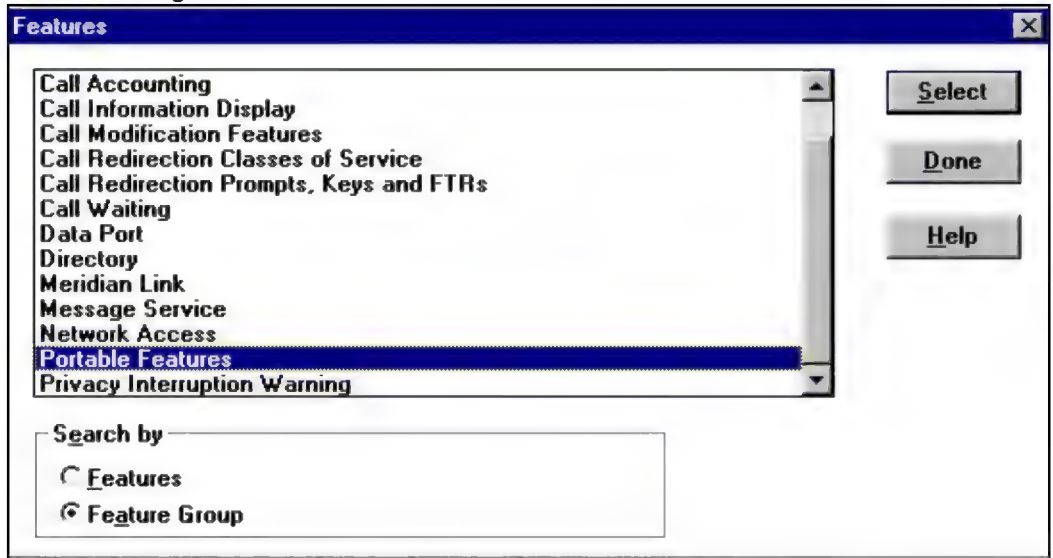
Visiting Portable (VISI)

You need to enter this information before the MAT can send the portable information to the Meridian 1 system.

- 9 To select a class of service or additional features, click Features.

The Features dialog box appears, as Figure 88 shows. You can search for individual features or feature groups in the list box. To give the portable a feature or class of service, highlight it and click Select. Click Done to return to the PORTABLE dialog box.

Figure 88
Features dialog box



- 10 To verify the portable's configuration, click Validate.
- 11 When you finish the configuration for a portable, click OK.
- 12 Click Admin to return to the Station Configuration dialog box, which lists all the stations currently configured for the Meridian 1 system. The portable you added appears in the list.

After you add a portable, it registers on the Microcellular system the first time the portable user makes a call on the system's frequencies.

Activating features from a portable

A portable user can activate or deactivate some features from a portable. The user can enter a Mobility SPRE code and a unique Feature Code to configure a particular feature, like on a wireline set.

For example, to set Call Forward to DN 2223, a portable user highlights the CFW Portable Feature and presses the Set button. The portable then prompts the user to enter the Redirection DN length and the Redirection DN. After entering the DN information, the user presses Set again. The features that are configured appear in bold lettering on the portable display.

Transmitting and retrieving Portable station information

After a Portable station is added or modified, the MAT transmits the station information to the Meridian_1 system through Overlay 11. The keys, features, and classes of service that are not applicable to Portable stations do not appear in the PORTABLE dialog box, but those prompts are still in Overlay 11. For any prompt that does not apply to the station, the MAT enters a carriage return to accept the default value on the Meridian 1 system.

Creating a Portable station like another station

Many Portable stations are used in conjunction with wired stations. You can create a new Portable station from an existing wireline station (or an existing Portable station). To copy a station, perform the following procedure:

- 1** In the Meridian 1 System window, choose Add Station from the Edit menu.
The Add Station dialog box appears.
- 2** Select the PORT station type from the Instrument list box.
- 3** Click the Create Portable from Location checkbox and enter the location of the station to be copied, as Figure 89 shows.

Figure 89
Create Portable from Location feature

Add Station

Number of Stations to Add
1

Customer Number
0

Template

Instrument	Instrument
M8314	8314 Analog
M8417	8417 Analog
M9009	9009 Analog
M9216	9216 Analog
M9316	9316 Analog
MCU	Meridian Communications Unit
PORT	Portable
QSU60	SL-1 Telephone
QSU61	SL-1 Digit Display Telephone
QSU7	SL-1 ACD Telephone

☐ Automatic Directory Number Assignment

☐ Automatic Terminal Number Assignment

☐ Phantom

☒ Create Portable from Location

OK Cancel Help

The MAT does not copy all of the data during a station copy because the Location value must be unique. It is not possible to copy the Location value from one station to another. Also, for a Portable station, there is no reason to copy the TN field.

After you select the station type and enter a location, the Station Configuration window appears with all of the field values copied from the original station except for the Location and TN fields, which remain blank. Only the features applicable to both stations are copied.

The copy feature is available only for creation of a new station. Once a station has been created, there is no association between the original station and the copied station.

The following figure displays an example of what appears after you select the Create Portable from Location field. In this case, the original station had values for the Name and Department fields and a configuration for the Call Forward key.

First Name

2500

Last Name

SET

Customer

2

Location

Department

4Y64

Portable Features

1	CFW	Forward 4 2223
2	CHT	Call Hold
3	MTS	

Set

Clear

Redirection DN Length

4

Redirection DN

2223

OK

Cancel

Features

Admin..

Validate

Help

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Verifying Microcellular system installation

To verify the installation of a Microcellular system, you need to test call reception and placement, call handoffs, and Microcellular interference outdoors.

Before you can perform these tests, you need the cellular operator to download the radio frequencies for the Microcellular system through the CMCP, if this was not done yet.

Testing call placement and reception

With a registered portable phone, place and receive calls from different locations in each cell to verify call placement and reception. If you have any difficulty placing or receiving calls, see “Troubleshooting portable problems” on page 266.

Place calls throughout the coverage area, monitoring for voice quality and paying particular attention to audio level and clarity. If call quality is not acceptable, check that the Microcellular signal strength is -85dBm or greater, and check for interference (at least -17dBm below the Microcellular signal strength).

Testing handoff for multiple cells

During intrazone handoffs, the portable switches from one cell to another when a handoff request is made by the EIMC. If you configure the portable on an Option 11C system, you might hear two “clicks” for handoffs: one click when the portable switches to the new cell and the other when the Meridian 1 Core software processes the handoff request and switches to the new cell. Otherwise, if you configure the portable on an Option 51C, 61C, 81, or 81C

system, you might hear one “click” for a handoff when the portable switches to the new cell.

If you have any problems with handoffs, see the troubleshooting information that follows or “Testing the radio frequency (RF) coverage” on page 147.

Troubleshooting portable problems

The following problems can cause a portable to be nonoperational:

- Portable not located
- Microcellular card failure
- Configuration problems
- CMCP heartbeat failure
- Meridian 1 INIT operation
- Noncompliance of portable
- Signal degradation
- Macrocell configuration problem
- Low on battery power
- Incorrect configuration
- Wrong mobile identification number (MIN) or electronic serial number (ESN)
- Wrong PSID or location ID
- Incorrect setting of RESEL_OFFSET for neighbor cells
- Portable not receiving calls
- For Multi-Site Networking, no available TLDN
- For Multi-Site Networking, D-Channel failure
- For Multi-Site Networking, Mobile User Directory (MUD) goes down

Portable not located

Portables that have moved out of range are not able to gain service. Also, a portable cannot be located in the following exception cases:

- An EIMC, MXC, or TRU-II is experiencing problems.

- The portable is turned off.
- The portable is momentarily in a radio blind spot. The expectation is that the user is moving and, therefore, will move out of the blind spot. If the user is not moving, the portable might remain in the blind spot.
- The cell in which the portable is located is unable to accommodate any more new calls. In this case, the user hears three short beeps.

In the event that a portable cannot be located, Call Forward No Answer treatment might be given, depending on configuration.

Microcellular card failure

Any failure of the EIMC or MISP causes all portables within the zone to be nonoperational. In the event of an EIMC or MISP failure, the Microcellular system might drop an existing call within the zone if a handoff is required.

Any failure of the MXC causes all TRU-IIs that the card supports to be nonoperational.

Configuration problems

An MISP installed in the wrong slot makes all portables nonoperational. (MISP applies only to Option 51C, 61C, 81, and 81C systems.)

Misconfiguration of connections to antennas or of the antenna structure might affect portables that TRU-IIs attached to those antennas service. Such misconfiguration might also make these portables unavailable.

CMCP heartbeat failure

In the event of three consecutive heartbeat failures, the CMCP automatically shuts down and locks the Microcellular system. The system drops all active calls involving portables and ceases service until the CMCP recovers the heartbeat.

Meridian 1 INIT operation

During an INIT operation on the Meridian 1 Core software, all calls that have not yet been transferred to a portable and certain established calls (per current operation) are dropped.

In the event of an INIT operation on the Meridian 1, the CTS may not be able to buffer all handoff requests until the Meridian 1 is operational again. Some handoff requests might be lost, resulting in calls being dropped.

Noncompliance of portable

If a user attempts to register or make an outgoing call from a portable that is either not complying to Microcellular parameters or not subscribed, the access is blocked. The blockage also applies to 911 calls.

Signal degradation

If a portable's signal level degrades past the handoff threshold but the call cannot be handed off (due to a problem such as an out-of-resource condition or a hostile RF environment), the call is dropped.

Macrocell configuration problem

If the portable does not find a Microcellular digital control channel (DCCH), this can be due to one of the following problems:

- The DCCH pointer on the public system might be set incorrectly.
- The external neighbor list might be set wrong if PSP/PDF is used on the portable.

Incorrect configuration

Any of the following incorrect configurations might cause a portable problem:

- If a portable uses PSP/PDF and the DCCH or ACH in the vicinity is not configured on the external cell, the portable does not find a Microcellular DCCH.
- If RSS_ACC_MIN, SID, SDC, PSID, SS_SUFF, or RESEL_OFFSET is not configured correctly, the portable does not camp onto a Microcellular DCCH, even with adequate signal strength.
- If RSS_ACC_MIN or MS_ACC_PWR is set incorrectly, the footprint of the microcell is either too small or too large.
- If the neighbor lists and camping parameters are set incorrectly, the portable keeps scanning before each reselection and does not go immediately to another channel.

Low battery power

When “low battery” is indicated on a portable, the battery must be recharged. Operation of the portable can degrade due to insufficient power.

Incorrect setting of reselection offset

If the RESEL_OFFSET value for an internal or external cell is set wrong in the Neighbor Cell properties, the portable ping-pongs between two cells.

Portable not receiving calls

If the portable can make outgoing calls but cannot receive incoming calls, the CLS for the portable should be configured with CFXA and CNDA. CPND must be configured for the portable.

D-Channel failure (Multi-Site Networking)

If a D-Channel failure occurs, a visiting portable can camp onto a macrocell channel. When the D-Channel comes up, the portable automatically registers with the visited Microcellular system through periodic registration or location registration.

Mobile User Directory (MUD) down (Multi-Site Networking)

If the MUD goes down, a visiting portable can camp onto a macrocell channel. When the MUD comes up, the portable automatically registers with the visited Microcellular system through periodic registration or location registration.

Testing Microcellular interference outdoors

The Microcellular system might need adjustment to reduce interference with the macrocellular system outdoors. To find out if Microcellular interference is a problem, walk outside with the ZK-SAM receiver to see how much the Microcellular system radiates. (The ZK-SAM manual describes how to measure RF signal strength.) Outside the building, the signal strength for the macrocellular system should be 3dB to 5dB greater than the Microcellular system signal.

Upgrading from VSELP to ACELP

To upgrade an existing Microcellular system from VSELP only service to ACELP/VSELP service, perform the following procedure:

- 1 Document the existing Microcellular configuration, including the interconnections between MXCs, MBSs, and radios.
- 2 Determine the number of MXCs (ACELP capable, NTEX80AB) required to support the given traffic based on the engineering rules for NTEX80AB.

Note: Each NTEX80AB card can support a maximum of nine simultaneous conversations. Ensure that there are sufficient slots in the IPE shelf for the new MXC configuration.

Change the TCM cross connections between the radios and MXCs according to the ACELP engineering rules. Each MXC can support one control channel and up to three voice channels.

The following engineering rules apply to ACELP/VSELP MXCs:

- One to 15 MXCs per IPE shelf
- One to 15 MXCs per Option 11C system, located in any cabinet
- One to 15 MXCs per EIMC
- Operates in any IPE slot
- Supports one control-channel radio and up to three traffic-channel radios (TDMA-3 voice or AMPS data)

For information about traffic calculations and additional engineering rules, see the *Nortel COMPANION Microcellular Site planning and deployment guide* (553-3611-105).

- 3 Load X11 Release 23 or later software.

- 4** Install MAT 5.71 or later software.
 - 5** Install Mobility System Management (MSM) 2.00 or later software.
 - 6** Delete Microcellular objects (from MSM object manager windows on the MAT) in the following order:
 - a** Radios
 - b** MBSs
 - c** MXCs
 - 7** Add and configure MXCs from the MXC Object Manager window, selecting ACELP service (TDMA-EFRC/VSELP) for each MXC. (Refer to “Configuring MXCs” on page 209.)
 - 8** Add and configure MBSs from the MBS Object Manager window. (Refer to “Configuring Microcellular Base Stations” on page 227.)
 - 9** Add and configure radios from the Radio Object Manager window. (Refer to “Configuring radios” on page 231.)
 - 10** Adjust the radio TCM cross connections to the MXCs based on the ACELP engineering rules.
 - 11** Unlock MXCs from the MXC Object Manager window.
 - 12** Verify the TCM connectivity, as described under “Configuring radios” on page 231.
 - 13** Download radio software, as described under “Configuring radios” on page 231.
 - 14** Unlock radio objects from the Radio Object Manager window.
- The Companion Microcellular system can now support ACELP traffic.

Appendix A: System messages and alarms

Table 29 lists the system messages that Microcellular events can generate.

Table 29
System messages for Microcellular events

Message Number	Event
BUG6472	Message header is too small.
BUG6473	Mobility virtual TN failed TNTRANS.
BUG6474	Message CR exists without a CRPTR for the specified cref on this TN.
BUG6475	Call reference flag is invalid for Setup Indication.
BUG6476	Message is less than expected length. IEs are missing.
BUG6477	Call rejected due to invalid timeslot.
BUG6478	Message ID is invalid.
BUG6479	Message received in invalid state.
BUG6480	Timeout occurred.
BUG6481	Case out of range.
BUG6482	MOB_INDATA_PTR is NIL. No incoming message is available to process.
BUG6483	Non-call processing message received when only a call processing message was expected.

Message Number	Event
BUG6484	Failed to send message to the MISP.
BUG6485	CRPTR is out of valid range.
BUG6486	Message CR is out of range.
BUG6487	Mobility data stored as non-key function does not exist.
BUG6488	Call reference is out of range.
BUG6489	Call register is out of range.
BUG6490	Call register could not be allocated for MSGCR.
BUG6491	Call reference specified is unexpectedly not being used.
BUG6492	Call reference specified is unexpectedly being used.
BUG6493	Timeout occurred in invalid state.
BUG6494	Invalid feature event occurred.
BUG6495	Unable to retrieve active call.
BUG6496	Feature key is not configured.
BUG6497	Two calls are in progress. Cannot activate call-related features.
BUG6498	Existing MSGCR found while attempting to set up a new incoming or outgoing call.
BUG6499	A CRRPTR exists without an MSGCR for this cref.
BUG6500	Cref check failed.
BUG6501	Invalid input from dial pad.
BUG6502	Only one digit per message is permitted for now.
BUG6503	Unable to set up a call on this TN with the specified cref.
BUG6504	Physical TN is invalid.
BUG6505	Cref returned by MOB_GET_CREF is invalid.
ERR5549	No output buffer is available to send SSD message.

Table 30 describes the alarms that Microcellular components can generate.

Table 30
Microcellular alarms

Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Core Events						
Info	MOB0000		<parm1>		Mobility System is initializing. Service will be available in a short period of time. Ignore <parm1>.	None
Crit	MOB0001		<parm1>		Mobility OAM task has restarted. Ignore <parm1>.	Report problem.
Crit	MOB0002		<parm1>		Mobility MSP task has restarted. Ignore <parm1>.	Report problem.
Info	MOB0003		<parm1> <parm2> <parm3> <parm4>		Message value passed for RFC call for system level messages is not supported. Ignore <parm1,2,3,4>.	Report problem.
Crit	MOB0050	MSUB <#>			Mobility subsystem has been manually shutdown by the cellular operator. Mobility service is no longer available.	Contact cellular operator to determine reason for shutdown.
Min	MOB0052	MSUB <#>			First scheduled keep-alive heartbeat was not received from cellular operator. Mobility service is still available.	Contact cellular operator to determine reason for heartbeat failure.
Maj	MOB0053	MSUB <#>			Second scheduled keep-alive heartbeat was not received from cellular operator. Mobility service is still available but will be disabled if another heartbeat failure occurs.	Contact cellular operator to determine reason for heartbeat failure.
Crit	MOB0054	MSUB <#>			Mobility subsystem has been automatically shutdown due to a keep-alive heartbeat failure. Mobility service is no longer available.	Contact cellular operator to determine reason for heartbeat failure.
Info	MOB0055	MSUB <#>			Mobility subsystem has been manually unlocked by the cellular operator.	None

Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Maj	MOB0168	EIMC <#>				
Zone Events						
Crit	MOB0100	Zone <#>			Could not enable the zone because there are no registered cells.	Create a Cell and assign it to the Zone.
Maj	MOB0102	Zone <#>			The zone could not register with a child cell as a usage state change client.	Delete the cell and create it again. Also notify design.
Cell Events						
Crit	MOB0103	Cell <#>			Cell does not have any radios available to configure a CCH.	Add a radio to the Cell.
Crit	MOB0104	Cell <#>			Cell does not have a CCH.	Control Channel Redundancy Failed. If all radios are busy, then either wait until calls on a radio end or lock and unlock one of the radios to forcefully drop the calls and make the radio to transmit on the CCH. Otherwise, add one more radio to the cell.
Maj	MOB0105	Cell <#>			CCH Failed. Redundancy in progress.	Self-clearing alarm. If redundancy works, this alarm will be cleared. If redundancy operation fails, this alarm will be cleared and a MOB0104 alarm will be raised.
Info	MOB0106	Cell <#>			Cell is Locked from Active usage state.	Any active calls were dropped.
Crit	MOB0107	Cell <#>			Parent Zone is Locked when the Cell was in Active state. Current Operational state of cell is Disabled with Dependency.	
Maj	MOB0108	Cell <#>			Link deactivation failed.	Lock the CCH radio.
Info	MOB0109	Cell <#>			Cell could not deregister as an usage state change client from the radio.	Report problem.

Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Min	MOB0110	Cell <#>			Cell could not register with a radio as a usage state change client.	Delete the radio and add it again. Contact NT support personnel to report event if problem persists.
Min	MOB0111	Cell <#>			An insert of HandOffPath into a Cells list failed.	Delete the handoff path and add it again. Contact NT support personnel to report event if problem persists.
Info	MOB0112	Cell <#>			Cell Locked/ShutDown from UiewPartOfServicesLocked state.	
Min	MOB0113	Cell <#>			Trying to register a radio having an unknown usage state, with the cell.	Delete the radio and add it again. Contact NT support personnel to report event if problem persists.
Min	MOB0166	Cell <#>	<Chan#> <RSSI> <BERR>		Noise or high BERR (bit error rate) detected on channel. RSSI values are in db and BERR values are in %. A value of 0 for BERR indicates no BERR value is being reported.	Channel should be replaced if this problem is continuously reported.
Info	MOB0167	Cell <#>	<Chan#>		Previously reported noise or high BERR (bit error rate) condition has been cleared.	None
MXC						
Maj	MOB0117	MXC <#>			Creation of M1Port Failed.	Report problem.
Info	MOB0118	MXC <#>			Xcoder Card was not found in the XcoderCard List.	Report problem.
Info	MOB0119	MXC <#>			Xcoder Tag was not found in the Xcoder Tag List.	Report problem.
Info	MOB0120	MXC <#>			Xcoder Tag List is not empty during the destructor of XcoderAllocator.	Report problem.
Info	MOB0121	MXC <#>			XcoderCard received an unknown message from the MXC.	Report problem.

Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Info	MOB0122	MXC <#>			An invalid MXC function code was passed from MxcOam Server.	Report problem.
Radio Events						
Crit	MOB0123	TRU <#>			CtsRadio does not have a valid MXC parent.	Delete the radio and add it back.
Crit	MOB0124	TRU <#>			Transceiver does not have a flash load.	Download the radio.
Crit	MOB0125	TRU <#>			Transceiver does not have a ROM load.	Report problem.
Crit	MOB0126	TRU <#>		TRU fault information in hex data stream.	Transceiver fault detected.	Report problem.
Maj	MOB0127	TRU <#>			Transceiver Flash load unknown	Report problem.
Maj	MOB0128	TRU <#>			Transceiver ROM load unknown	Report problem.
Info	MOB0129	TRU <#>			CtsRadio Flash version mismatch.	Decide whether to download the radio.
Info	MOB0130	TRU <#>			CtsRadio ROM version mismatch	Report problem.
Info	MOB0131	TRU <#>			Transceiver PEC not set	Report problem.
Info	MOB0132	TRU <#>			Locking CtsRadio	Report problem.
Info	MOB0133	TRU <#>			Shutting down CtsRadio	Report problem.
Info	MOB0134	TRU <#>			CtsRadio is being moved to another Cell.	None.
Info	MOB0135	TRU <#>			CtsRadio tcmPort mismatch	Delete the radio and add it back.
Info	MOB0136	TRU <#>			Invalid capability length.	Report problem.
Generic Events						
Info	MOB0137	CTS <#>			Bind to a remote ORB object failed.	Report problem.
Info	MOB0138	CTS <#>			Method invocation on a remote ORB object failed.	Report problem.

Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Info	MOB0139	CTS <#>			A pointer (to a remote or local object/structure/simple data member) failed validation (either zero or a NullProxy).	Report problem.
Info	MOB0140	CTS <#>			Memory Allocation Error. A dynamic memory allocation failed.	Report problem.
MXC Events						
Mn	MOB0150	MXC <#>	<DSP #>		A DSP failed and could not be rebooted. The card may continue to work with decreased capacity provided other DSPs are still available.	Reboot card to restore full capacity.
Crit	MOB0151	MXC <#>			All DSPs have failed. MXC card is no longer operational.	Reboot card. If problem persists, replace card.
Crit	MOB0152	MXC <#>			DSP configuration for TDMA 3 has failed.	Reboot card.
Info	MOB0153	MXC <#>			A DSP debugger task has been started from the front panel DIN-8 connector. All calls in progress should be maintained but all new call requests will be rejected.	None.
Info	MOB0154	MXC <#>			The DSP debugger task has been exited.	None.
Min	MOB0155	MXC <#>			Mismatch between base code load and version file.	Reboot card. If problem persists, verify proper installation of MXC base code.
Crit	MOB0156	MXC <#>			Hardware Initialization Failure. Failed to initialize communication link with radios.	Reboot card. If problem persists, replace card.

Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Crit	MOB0157	MXC <#>	<Error code>		Hardware Initialization Check Failure. Indicates a problem encountered during initialization, when a sanity check is performed by the radio link software, following a chip reset. One of the A31 internal registers, read by the software, was initialized with an invalid value. The A31 chip on the MXC card may be inoperational The error code indicates that one of the following A31 registers' initial value did not match the specified value: 02 MSTAT 03 ATEST 04 PRES 05 TBUF0 06 TBUF1 07 TBUF2 08 CONF1 09 IDLE	Reboot card. If problem persists, replace card.
Crit	MOB0158	MXC <#>			Software Initialization Failure. The pSOS+ operating system was not able to allocate a memory segment for use by the radio link software.	Reboot card. If problem persists, replace card.
Crit	MOB0159	MXC <#>			Software Initialization Failure. The pSOS+ operating system was not able to allocate a memory region for use by the radio link software.	Reboot card. If problem persists, replace card.
Crit	MOB0160	MXC <#>			Software Initialization Failure. The pSOS+ operating system was not able to allocate a buffer partition from the memory segment used by the radio link software.	Reboot card. If problem persists, replace card.
Crit	MOB0161	MXC <#>			Software Initialization Failure. The pSOS+ operating system failed in creating one or more radio link processes.	Reboot card. If problem persists, replace card.
Crit	MOB0162	MXC <#>			Software Initialization Failure. The radio link software failed in the execution of one or more of its process (task) initialization routines.	Reboot card. If problem persists, replace card.

Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Crit	MOB0163	MXC <#>			Software Initialization Failure. The pSOS+ operating system failed in starting one or more radio link processes.	Reboot card. If problem persists, replace card.
Info	MOB0164	MXC <#>			The radio link queue manager utility could not enqueue new buffers. The queue can hold up to 255 buffers. This can occur under extreme traffic conditions and should clear itself when traffic diminishes.	Reboot the card if the condition does not clear itself after traffic has diminished. If problem persists, replace card.
Info	MOB0165	MXC <#>	<Error Code>		The pSOS+ operating system could not obtain a buffer from the buffer partition reserved for use by the radio link software. This can occur under extreme traffic conditions and should clear itself when traffic diminishes. Error code is a 4 byte field which indicates the pSOS+ error code. This is for NT use only.	Reboot the card if the condition does not clear itself after traffic has diminished. If problem persists, replace card.
AFP Events						
Min	MOB0200	AFPR <#>			AFP has reached convergence. This is the state where AFP has completed selecting a set of channels.	The installer can now unlock the cell(s).
Crit	MOB0201	AFPR <#>			AFP has not found enough channels to propagate to all radios.	Contact your cellular operator.
Min	MOB0202	AFPR <#>			Backup channels list is not full. AFP was unable to find enough backup channels to fill the backup list.	The backup list may be too big or the RSSI thresholds may be incorrectly set.
Maj	MOB0203	AFPR <#>			Backup channels list is only 1/4 or less full. AFP was able to only fill up 1/4 or less of backup channels list.	The backup list may be too big or the RSSI thresholds may be incorrectly set. Contact your cellular operator.

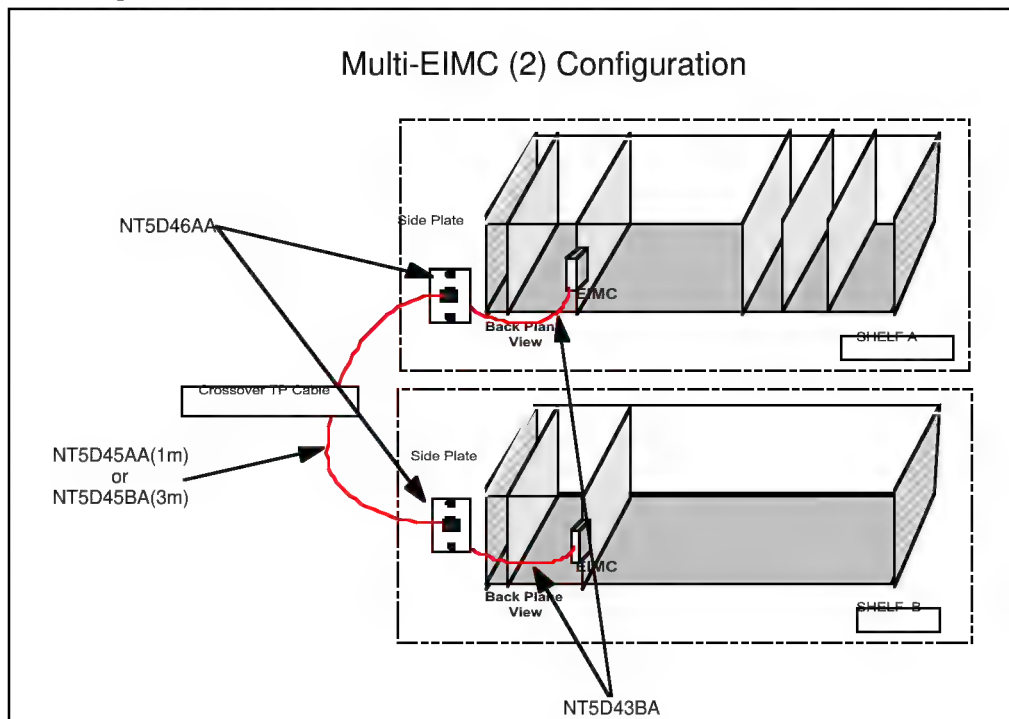
Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Maj	MOB0204	AFPR <#>			Backup channels list is empty. AFP was unable to find any channels to place in this list.	RSSI thresholds may be incorrectly set or external RF conditions may be impacting system. Contact your cellular operator.
Info	MOB0205	AFPR <#>	<BER a> <chan#>		Bit error rate of "a" % is detected on a traffic channel.	None, AFP will remove this channel if condition persists.
Info	MOB0206	AFPR <#>	<chan a> <chan b>		AFP has substituted traffic-channel "a" with "b".	None
Min	MOB0207	AFPR <#>	<chan a>		External cell with control-channel "a" can no longer be detected. AFP will update the system data if it is configured to do so.	If not configured, cellular operator should modify external cell "a" to reflect the changing environment.
Min	MOB0208	AFPR <#>	<chan a>		AFP has detected a new external cell with control-channel "a". AFP will update the system data if it is configured to do so.	If not configured, cellular operator should configure new external cell "a". Cellular operator needs to configure neighbor list to include the new external cell regardless of whether the external cell is configured automatically or manually.
Min	MOB0209	AFPR <#>	<chan a>		AFP has detected that macrocell pointer-channel "a" has been removed. The pointer is a macrocell neighbor list entry which points to a Microcellular control channel.	If possible, cellular operator needs to reprogram pointers.
Min	MOB0210	AFPR <#>	<chan a>		AFP has detected interference on macrocell pointer-channel "a". The pointer is a macrocell neighbor list entry which points to a Microcellular control channel.	Cellular operator needs to configure a different Microcellular control channel.
Crit	MOB0211	AFP			AFP host is NOT responding	Check condition of the MSM MAT running the AFP application. Reboot the MAT if necessary.

Sev	Alarm ID	CompID	OpData	ExData	Description	Action
Info	MOB0212	AFP			AFP Host is responding.	None, typically seen after a MOB0YYY message.
Maj	MOB0213	AFPR <#>	<AFPS#>		An AFP Station is not responding.	Check that the AFP station is receiving power and that the AFP station is cabled correctly.
Debug Event						
Info	MOB9997	<comp>	<id> <opdata>	<exdata>	This is an SL1 mobility debug message. It should not be output unless NT support personnel are debugging.	Report problem.
Info	MOB9998	<comp> <x>	<type> <code> <opdata>	<exdata>	This is a mobility debug message. It should not be output unless NT support personnel are debugging.	Report problem.
Default Event						
Info	MOB9999	<comp> <x>	<type> <code> <opdata>	<exdata>	An undocumented mobility event was reported.	Report problem.
Misc. Events						
n/a	SCH6735				Portable MIN and ESN fields cannot be changed.	Delete and re-add portable to change MIN or ESN.
Maj	SYS0053				Microcellular packages restricted. Mobility related data will be removed from database.	For Microcellular/ Mobility, packages 302 (.MOSR) and 303 (.MMO) are required. Contact you technical support group.
Maj	SYS0054				Mobility related data blocks are removed. Possibly super-loop block does not exist.	Contact you technical support group.

Appendix B: Inter-EIMC communications

The Ethernet interface on the EIMCs provides inter-EIMC communications. To connect two EIMCs, you attach a Crossover TP cable to the side plate of one EIMC and the back of the other, as Figure 90 shows.

Figure 90
Connecting two EIMCs



Appendix C: MBS to antenna tables

MBS #1	
Antenna port	To hybrid
1	
2	
3	
4	

MBS #2	
Antenna port	To hybrid
1	
2	
3	
4	

MBS #3	
Antenna port	To hybrid
1	
2	
3	
4	

MBS #4	
Antenna port	To hybrid
1	
2	
3	
4	

Dual 8-Port Hybrid #1			
From MBS	Input port	Output port	To antenna
	IN 1	OUT 1	
	IN 2	OUT 2	
	IN 3	OUT 3	
	IN 4	OUT 4	
	IN 5	OUT 5	
	IN 6	OUT 6	
	IN 7	OUT 7	
	IN 8	OUT 8	

Definitions: T = Terminator
 N/A = Not Applicable

Dual 8-Port Hybrid #2			
From MBS	Input port	Output port	To antenna
	IN 1	OUT 1	
	IN 2	OUT 2	
	IN 3	OUT 3	
	IN 4	OUT 4	
	IN 5	OUT 5	
	IN 6	OUT 6	
	IN 7	OUT 7	
	IN 8	OUT 8	

Quad 4-Port Hybrid			
From MBS	Input port	Output port	To antenna
	IN 1	OUT 1	
	IN 2	OUT 2	
	IN 3	OUT 3	
	IN 4	OUT 4	
	IN 5	OUT 5	
	IN 6	OUT 6	
	IN 7	OUT 7	
	IN 8	OUT 8	

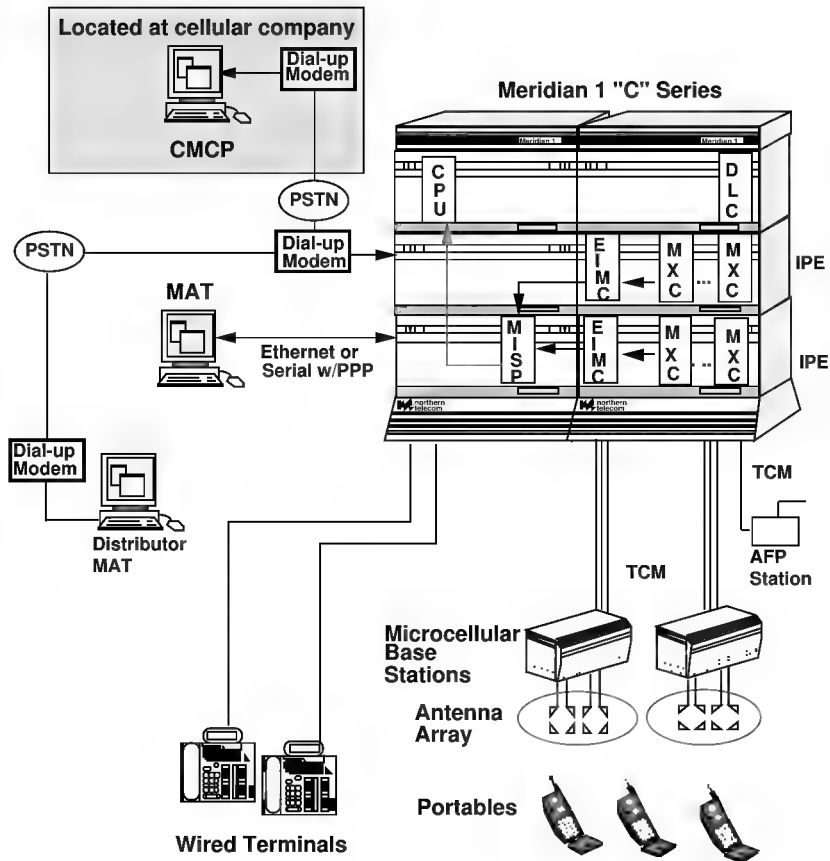
Appendix D: Cellular operator guide

Microcellular product overview

COMPANION Microcellular provides users both in-building and wide area mobility using a single standard cellular portable. It is a low-power private system supporting the IS-54B and IS-136 radio protocols and operating in the 800 MHz cellular band. The Microcellular system reuses the frequency spectrum from the existing macrocellular system. A maximum of 3,000 private mobility users can be supported on a Microcellular system.

The Microcellular product is fully integrated with the Meridian 1 PBX. It may also be used as an adjunct behind SL-1, SL-100 and most other PBXs, using ISDN PRI or TIE trunks. Operations, Administrations & Maintenance (OA&M) is provided via Meridian Administration Tools (MAT) Release 5. Standard Intelligent Peripheral Equipment (IPE) cards provide the control functions for the Microcellular system. The system's radios are located within a Microcellular Base Station (MBS) which may be located in an equipment closet up to 3,000 feet from the Meridian 1. Antennas are then distributed throughout the premises and connected to the MBS via coaxial cable. Other distribution methods can also be used, such as fiber optic cable. Standard cellular portables (Dual-Mode AMPS/TDMA) conforming to either IS-136 or IS-54B standards are used.

Figure 91
Microcellular system



553-7599

With the Microcellular product, users also have personal mobility across multiple Meridian 1's within an enterprise network. With the Multi-Site Networking (MSN) option, users may move between Meridian 1 systems connected by a private ISDN network and make and receive calls on their portables.

Microcellular hardware and software components

A Microcellular system requires the following major software and hardware components; additional components, such as connectors and cables, are listed and described in the installation and site planning and deployment documents:

Meridian 1 systems: The Microcellular product is supported on Meridian 1 Options 11C, 51C, 61C, 81 and 81C running X11 Release 22 or later software.

Multi-Purpose ISDN Signaling Processor (MISP): Routes messages between the Meridian 1 CPU and the Embedded Intelligent Mobility Controller. The MISP is not required on an Option 11C system.

Embedded Intelligent Mobility Controller (EIMC): Controls all messages for air interface handling, call processing, location tracking, and handoff.

Microcellular Transcoder Card (MXC): Provides transcoding of voice within the Microcellular system. In an Option 51C, 61C, 81, or 81C system, an MXC must reside on the same IPE shelf as its associated EIMC. In an Option 11C system, an MXC can reside in the main cabinet with the EIMC or in an expansion cabinet.

The MXC provides both TDMA-3 Algebraic Code Excited Linear Predictive (ACELP) and TDMA-3 Vector Sum Excited Linear Predictive (VSELP) services. ACELP implements the IS-641 protocol to provide enhanced digital voice quality.

Microcellular Base Station (MBS): Each MBS contains up to four dual-mode TRU-II radios. The MBS may be placed at various locations within the customers's building, up to 3,000' away from the Meridian 1. All radio channels can be simulcast onto all antennas within the same cell to cover high density areas economically.

TRU-II radio: Each TRU-II radio supports one control channel or one TDMA traffic channel. One control channel radio and one traffic channel radio is always required in each cell; additional traffic channels may be added as needed to increase capacity. One TDMA traffic channel can carry up to three simultaneous conversations.

Distributed antenna system (includes Antennas and distribution media): Directional or omni-directional antennas can be used.

Cellular portables: Industry standard, dual-mode AMPS/TDMA portables supporting either IS-136 or IS-54B standards are supported.

Automatic Frequency Planning (AFP) Station: A scanner/receiver that helps the Cellular Operator maintain the frequency plan to prevent interference with the macrocellular system and to maintain signal quality for the Microcellular system. A Microcellular system supports up to 12 AFP stations.

Mobility System Management Terminal (MSM): a PC-based tool that provides Distributors a platform for installation of Microcellular components and for Microcellular operations, administration, and maintenance (OA&M). The MSM application can be run on a local or a remote PC.

The AFP application, which is part of MSM, will retrieve the data necessary from the AFP Stations in order to select and monitor a set of frequencies for the Microcellular system. All of the necessary statistical analysis needed to make these decisions are performed by the AFP application. AFP requires a local MSM running 24 hours a day.

Cellco Mobility Control Point (CMCP): a PC-based tool for radio frequency (RF) management, enables a cellular company to control the use of voice and control channels by Microcellular systems within its licensed region. The CMCP provides the only “control” interface to the AFP feature. It also provides the ability to set RF parameters and shutdown subsystems, if needed. Located at the cellular company site, the CMCP connects with the Meridian 1 system through a modem (PPP) connected through a Public Switching Telephone Network (PSTN). One CMCP can manage multiple Microcellular systems.

Microcellular logical components

A Microcellular system also includes the following logical components:

Zone: A zone represents a geographic coverage area made up of smaller coverage areas (cells). A single EIMC serves each zone.

Cell: A cell (or partition) represents a geographic coverage area that is served by the Microcellular system. A specific control channel and one or more traffic channels serve each cell. Both the control and traffic channels can be used simultaneously in other cells in the same Microcellular system, provided the cells are not adjacent.

Each cell can support up to 15 TRU-IIs. For practical purposes, this limits a cell to four MBS components (because each MBS can support up to four TRU-IIs).

Handoff Path: A handoff path defines a relationship between two adjacent cells for the purpose of handoff.

AFP Region: An AFP region represents a geographic coverage area that is covered by one or more AFP stations for detecting frequency interference and automating frequency selection.

Heartbeat: Periodic signal between the CMCP and a Microcellular system. If the heartbeat application is enabled and the Microcellular system fails to receive three consecutive heartbeats, the Microcellular system will stop transmitting over the air interface.

System Management Responsibilities

Figure 92 summarizes the management responsibilities of operating, administering, and maintaining a Microcellular system.

Figure 92
Key system management responsibilities

	
Mobility System Management	Cellco Mobility Control Point
DISTRIBUTOR	CELLULAR OPERATOR
•H/W installation, configuration & maintenance •Portable administration •Multi-site networking configuration •Alarm management •Traffic management •AFP application	•Channel assignments •Keep-alive heartbeat •IS-136/54B parameter configuration •Microcellular subsystem activation and shutdown •AFP parameter configuration •Max portables •Alarm Management •Traffic Analysis

Table 31 provides a quick reference of MSM and CMCP capabilities.

Table 31
MSM and CMCP Capabilities

	Lock/ Unlock	Add/ Delete	Change	View
MISP	M	M	M	M
EIMC	M	M	M	B
MXC	M	M	M	B
MBS	N/A	M	M	B
Radio	M	M	M	B
Subsystem	C	N/A	B	B
Zone	B	M	C	B
Cells	B	M	C	B
Cells (Neighbor Lists)	N/A	C	C	B
External Cells	N/A	C	C	B
AFP Regions	M	N/A	C	B
AFP Region (Stations)	N/A	M	M	B
Portables	N/A	M	M	M
Multi-Site Networking (MSN)	M	M	M	M
Mobility Alarms	M	N/A	N/A	B
Mobility OMs	M	N/A	N/A	B
Legend: M = MSM C = CMCP B = Both N/A = N/A				

The Cellular Operator has critical control of Microcellular systems via the CMCP PC. For instance, in the event that a Microcellular system operates in an undesirable mode, the Cellular Operator can shutdown the whole Microcellular system by locking the subsystem. Once the subsystem becomes locked, the Microcellular system disconnects all existing mobility calls and ceases serving new mobility calls. Also, only the Cellular Operator can put the Microcellular back in operation by unlocking the subsystem.

Micro / Macro Interaction

The COMPANION Microcellular system is a semi-autonomous private system. This means that it is not a part of the public network. An autonomous IS-136 microcell system can be supported in two ways:

- 1 Neighbor Cell pointers (macro dependent)
- 2 Public Service Profiles/Private Operating Frequencies (PSP-POF) portables

Neighbor Cell Pointers

Each cell within a macrocellular system maintains its own neighbor cell list. The list contains a DCCH of, and a pointer to, each neighbor cell, both macro and micro. As a portable moves from a macro service area into a micro service area, the portable uses the pointers in the macro neighbor cell list to search for microsystems.

Similarly, each microcellular system maintains its own neighbor cell list, with inclusion of pointers to its macro neighbors. The neighbor list provides fast reselection of the macro when a portable leaves a micro coverage area. The micro neighbor cell lists must be configured via the CMCP.

Note that this scheme applies to IS-136 with DCCH only.

PSP-POF Scheme

This scheme requires IS-136 phones that support PSP/POF and microcellular systems that support Test Registration. Test Registration is a function that allows PSP/POF information to be updated on portables. The COMPANION Microcellular system supports Test Registration.

With PSP/POF, there is no need to program information of Microcells on macro neighbor lists for the purpose of reselection. PSP/POF allows an IS-

136 phone to be programmed with information about the surrounding macrocell, along with information about the Microcellular system. When the portable enters the overlaying macrocell, it recognizes it is in the vicinity of its home microsystem and begins searching for the Microcellular system. This is a preferred neighbor relationship so once the portable sees the Microcell control channel above a predefined value, it will reselect into the Microcell.

Once the Microcellular system is active, a PSP/POF portable needs to be programmed. This is completed by performing a new system search from the portable. The portable will search the first strongest 24 cellular channels and find any private system. When the portable finds a private system, it will query the user to select the system or keep searching. Once the user selects a system, the portable will attempt to register on that private system. If the registration is successful, the portable will initialize or modify its PSP/POF list by reading the neighbor list information on both the macro network and the Microcellular system. All reselection information will be included in these lists.

Within a multi-cell Microcellular system, each cell needs to have every cell in the system defined as a neighbor. This will allow the portable to download all the private operating frequencies, making sure that the portable can reselect from the macrocell to any of the Microcell cells.

For multi-site networking, the portable is required to perform a system search at a visiting site.

Allowable Microcellular Solutions

The Microcellular product supports the IS-54B and IS-136 radio protocols. The Cellular Operator must select the method of operation for each microcellular system based on the environment of the overlaying macrocell. Table 2 illustrates allowable microcell solutions. In a non-TDMA macro environment, an IS-136 portable will camp on a TDMA control channel while

in a micro service area and an analog control channel while in a macro service area. Nortel recommends the IS-136 solution with PSP/POF (Rev A) phones.

Table 32
Micro / Macro Solutions

Macro Infrastructure (800 MHz)	IS-136 (Microcellular)	IS-54B (Microcellular)
AMPS	PSP/POF phones required	Best server design required
TDMA IS-54B/AMPS	PSP/POF phones required	Best server design required
TDMA IS-136/AMPS	PSP/POF phones preferred; Rev 0 phones require Microcells to be included in Macro neighbor lists	N/A
CDMA/AMPS	PSP/POF phones required	Best server design required

Note that if non-Rev A phones are used, macro neighbor lists must be programmed to include Microcellular cells.

Cellco Mobility Control Point (CMCP)

The Microcellular system reuses the frequency spectrum used by the existing macrocellular system. Thus, careful provision of frequency reuse among the macro systems and Microcellular systems is important. To prevent any negative impact to the operation of the macrocellular system, only the Cellular Operator can perform RF management of microcellular systems operating within its service region.

The Microcellular system allows the Cellular Operator to control the use of voice and control channels within its private coverage area through the Cellco Mobility Control Point (CMCP), located at the cellular company site. The major functions of the CMCP, performed by the cellular operator, include the following.

- Manually or automatically allocate radio frequency channels to the Microcellular system.
- Complete the configuration of zones and cells, including certain radio system parameters.
- Configure AFP parameters and thresholds and control AFP operation.
- Configure and maintain the keep-alive heartbeat for the Microcellular system.
- Enable and disable operation of the Microcellular system.
- Secure ESNs.
- Specify maximum number of portables allowed.

Each Meridian 1 system equipped with Microcellular provides a dial-up port for the CMCP. Before a Microcellular system can operate, the cellular operator needs to complete the configuration of Microcellular zones and cells, including the allowed voice and control-channel frequencies and radio parameters for the Microcellular system. While a Microcellular system operates, it responds to the keep-alive heartbeat sent by the CMCP, if heartbeat is enabled.

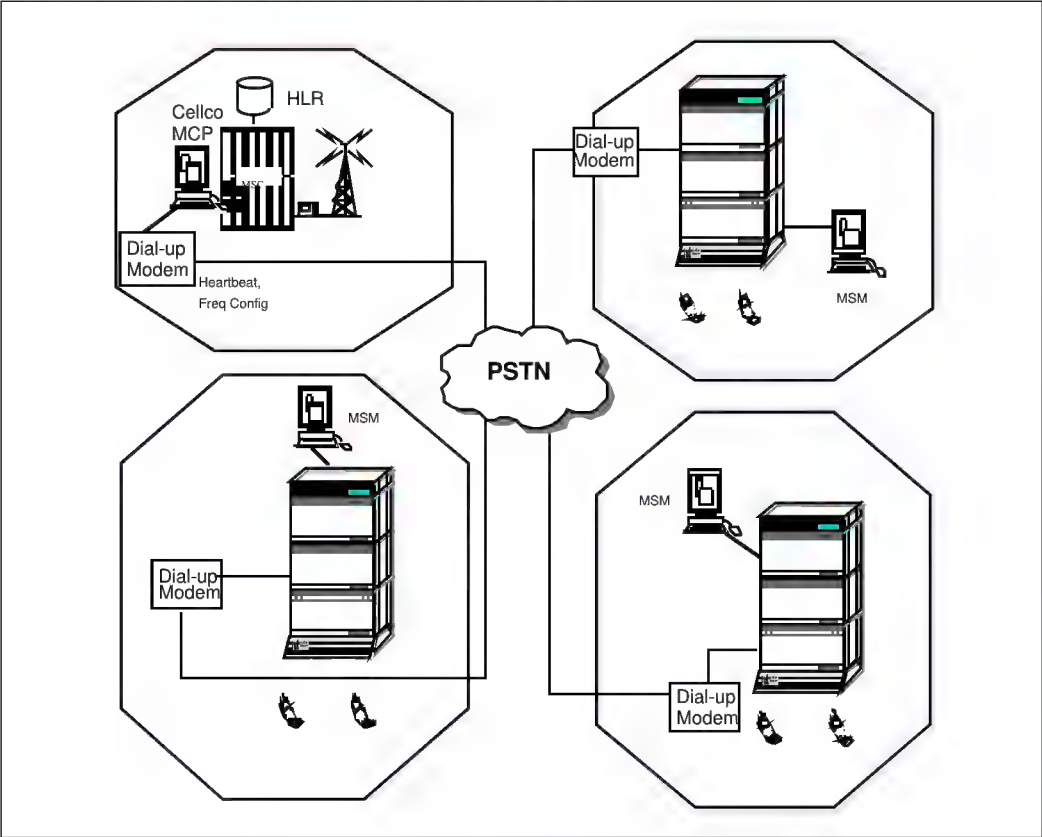
Through a Meridian 1 system, the CMCP establishes the connection with the Microcellular system, reestablishes the connection if it is lost, and initiates communications with the Microcellular system.

One CMCP can manage multiple Microcellular systems, belonging to the same enterprise network or different customers, as shown in Figure 93. A CMCP with a single port can only manage one system at a time. Connecting to multiple Microcellular systems simultaneously requires multiple ports.

Also, multiple CMCPs can connect to the same Microcellular system. This capability allows the Cellular Operator to troubleshoot a Microcellular system from a local or a remote site with a lap-top PC.

The CMCP establishes the connection to each Microcellular system at configured time intervals to send and receive the keep-alive heartbeat, if heartbeat is enabled.

Figure 93
CMCP managing multiple Microcellular systems



CMCP Requirements

Recommended requirements for the CMCP PC

An IBM PCTM or compatible with the following minimum configuration:

- 1 Pentium 75 MHz CPU
- 2 SVGA color monitor and interface card(800 x 600 Resolution for graphics)
- 3 Minimum of 500 MB of free space on hard drive (includes Windows 95TM requirements)
- 4 32 MB RAM
- 5 3.5" floppy drive
- 6 PC COM port with 16550 UART
- 7 Parallel port
- 8 MS Windows 95 (with Microsoft TCP/IP installed)
- 9 US Robotics modem (28.8 or better) or any 100% Hayes compatible modem
- 10 Two button mouse
- 11 Printer
- 12 CD ROM

It is recommended that this IBM PCTM or compatible be dedicated as a Microcellular CMCP to minimize any software or hardware conflicts.

Software requirements

- 1 MAT 5.7 software or later
- 2 Microcellular CMCP software

Note: The PC must have an available serial port (i.e., one not being used by a mouse or other serial device) for external modems or direct connection. The number of PC COM ports required depends on the number of external modems or direct connections required.

CMCP package contents

The CMCP package delivered by Nortel contains the following items:

- 1 MAT 5.7 software
- 2 CMCP software
- 3 Security dongle (for new CMCP PCs only)
- 4 Meridian 1 Nortel COMPANION Microcellular Cellular Operator guide
- 5 Meridian Administration Tools MAT 5 Common Services User guide

The CMCP installation instructions given in this document and the *Meridian Administration Tools Common Services User guide* (A0658266) assume you are familiar with PC systems and the Microsoft Windows '95 environment, such as dial-up networking, TCP/IP dial-up configurations, Hyperterminal or equivalent software, and modem configurations. You should be familiar with the Windows environment before attempting to install and use the CMCP system.

Automatic Frequency Planning

The AFP feature minimizes the Cellular Operator's effort in managing the frequency plan for a Companion Microcellular system during installation and operation. This feature requires X11 Release 23 software.

The following sections describe AFP features, AFP station and algorithm. For AFP configuration, see "Configuring and maintaining Microcellular systems" section.

Automatic Frequency Planning features

The AFP application allows the Cellular Operator via the CMCP to:

- configure key AFP parameters
- specify channels not to be used by AFP
- override channels selected by AFP on a per cell basis
- turn off AFP for the Microcellular system
- configure channel separation
- query the Microcellular system for AFP algorithm's current list of usable channels

The AFP application can automatically select an initial set of control and traffic channels. It scans all forward and reverse channels within the 800 MHz band that are not on the “prohibit” list. The prohibit list generated by the Cellular Operator contains a set of channels that cannot be used by the Microcellular system.

Convergence, a stage in which AFP has generated a set of stable channels to be used by the system, may take 30 minutes to three days, depending on the AFP parameters set via the CMCP. The quality of the selected channels is highly dependent upon the stability of the macro RF environment as well as the duration AFP spends on evaluating channels. If automatic channel selection is chosen during installation, AFP generates an alarm when convergence is reached.

As an option, the Cellular Operator can assign the initial control and traffic channels for the Microcellular system without having to wait for convergence. This option is called seeding.

After initial frequencies are obtained, the AFP application can do a forward and reverse scan of all channels not on the “prohibit” list to maintain a set of frequencies to be used as replacement frequencies for traffic channels. This means that AFP automatically maintains a list of usable traffic channels that will adapt to the changing RF environment while the Microcellular system is in operation.

The AFP application automatically configures each “external” cell, which can be either an overlaying or an adjacent macrocell, on AFP startup. AFP

extracts control channels from macro cell control channel neighbor list on AFP startup.

During operation, the AFP Station extracts information from macrocell control channels, and the AFP application uses that information to compose the neighbor list for the Microcellular system. Upon detecting a change on macrocell preferred neighbor list that affects the operation of a Microcellular system, AFP generates an alarm.

If not enough frequencies are found for the Microcellular system, AFP generates an alarm, while distributing available frequencies to cells and continuing service to Microcellular users.

AFP monitors BER on active traffic channels. Upon detection of an increasing BER and a steady RSSI for a traffic channel, AFP increments a threshold. If the threshold of a channel exceeds a parameter set via the CMCP, AFP abandons the old channel, assigns a new channel from the backup channel table to the active call, and raises an alarm.

In addition, AFP sniffs for traffic on idle traffic radios. Upon detection of interference, AFP increments a threshold. If the counter of a channel exceeds a threshold parameter set via the CMCP, AFP replaces the old channel with a clean channel from the backup channel table and generates an alarm.

The Cellular Operator can view the alarms via a buffer box setup (see “Buffer box implementation” section).

Automatic Frequency Planning Station (AFPS)

The AFP station is a scanner/receiver that helps the Cellular Operator maintaining the frequency plan to prevent interference with the macrocellular system and to maintain signal quality for the Microcellular system. The AFPS can perform the following tasks:

- Measure both forward and reverse Received Signal Strength Indicator (RSSI) on a specified channel or channels.
- Tune to each macrocell control channel and extract: SAT, SOC, MCC, DVCC/DVC and SID.
- Return the Bit Error Rate (BER) on a specified microcell control channel.

It can be deployed throughout the physical domain of a Microcellular system.

Each AFPS can connect to a Digital Line Card (DLC) port on the Meridian 1 system through a twisted pair connection. The AFP software running on MSM dials up an AFPS through a Meridian Communication Unit and queries the AFPS for data such as the RSSI and BER on specified channels. Part of Mobility System Management, the AFP software must run 24 hours a day on a locally connected PC that has access to the Meridian 1 system through an Ethernet interface.

Instead of twisted pair cabling, an AFPS can also be connected to the Meridian 1 system using short-haul modems and RS-232 cable. A dedicated short-haul modem is required for each AFPS.

AFP algorithm

The AFP application uses the AFP Station(s) to continuously monitor RSSI on all allowed frequencies. Channels are ranked and divided into two lists, backup and residual. The sizes and thresholds of those two lists are configurable via the CMCP. The backup list contains a list of channels suitable for substitution into the traffic radios upon detection of interference on traffic channels. The residual list contains a list of channels unsuitable for use in traffic radios based on parameters set by the Cellular Operator via the CMCP. Additionally, surplus backup channels go on the residual list.

Upon receiving results from the AFP station(s), the most pessimistic reading is taken and stored in the appropriate list. After results are stored in the list, the backup list is resorted and channels above a configured threshold are moved to the residual list. This process continues until the statistical analysis timer, which is configurable via the CMCP, expires.

During the statistical analysis phase, the measurements of current backup and residual channels are copied into a Long Term Data Matrix (7 days x 24 hours). Then uplink/downlink N Percentile calculation is made on each channel. Based on historic performance, channels which have shown consistent improvement may be promoted from the residual list to the backup list. Channels which show consistently bad or inconsistent performance remain on the residual list. After the statistical analysis completes, the cycle repeats again. The AFP scanner is asked to measure the backup list and the residual list.

Planning and installing a Microcellular system

Nortel manufactures Microcellular products and sells them via Meridian 1 distribution channels. The Meridian 1 Distributors then sell the products to customers. Upon a sale, a Distributor provides installation and maintenance services to the customers. During installation and operation, the Cellular Operator, focused on radio frequency engineering, works in conjunction with the Distributor.

Planning, installing and operating a Microcellular system require the activities given in this section. Note that the section employs the following conventions: (i) **bold** characters indicate tasks to be performed by the Cellular Operator, (ii) ***bold-italic*** characters indicate tasks to be completed by the Distributor in conjunction with the Cellular Operator, and (iii) regular characters indicate tasks to be done by the customer or the Distributor.

Note that some Cellular Operators/Distributors may choose to divide responsibilities differently than shown below.

Site planning and deployment

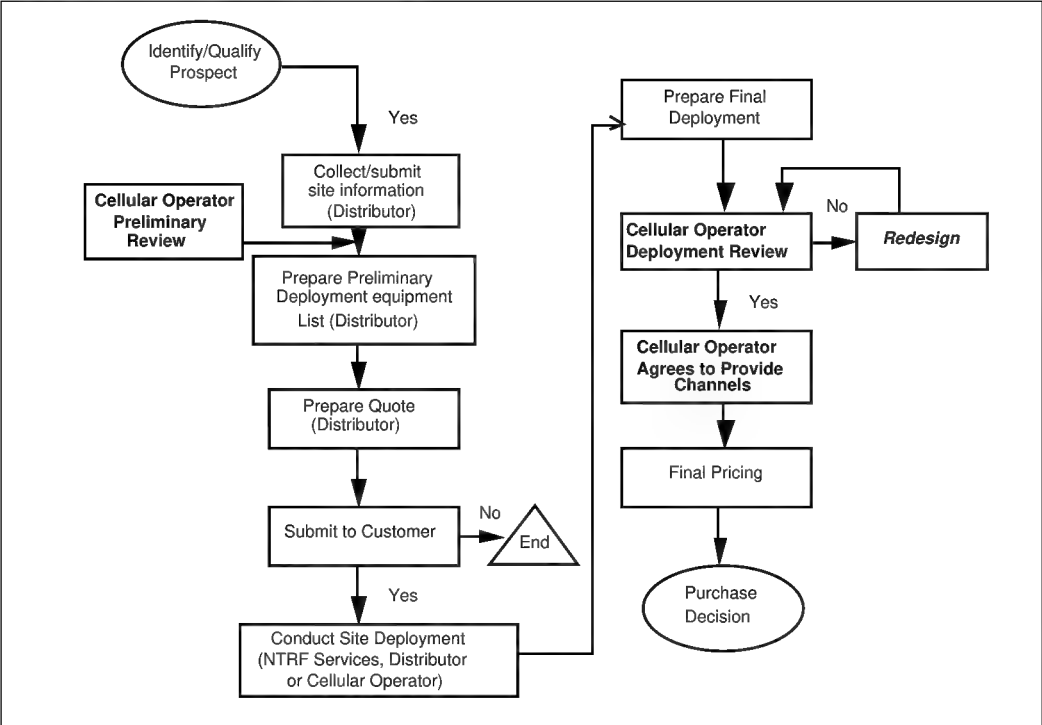
The site planning and deployment procedure for a Microcellular system follows:

- 1 The customer completes the Microcellular Customer Information form, with the sales representative.
- 2 For Microcellular sites that plan to use the IS-54B CAI (common air interface) protocol and/or AFP, the sales representative or sales support engineer takes preliminary Received Signal Strength Indicator (RSSI) readings at the customer site and sends the RSSI readings to the Distributor.
- 3 The Distributor gives the customer information form and the RSSI readings (only needed for IS-54B and/or AFP) to the site planning engineer, along with floor plans, if available, for the proposed Microcellular site. The Distributor can request site planning services from Nortel.
- 4 The site planning engineer runs a software tool to simulate and analyze a distributed antenna system for the proposed Microcellular system.

- 5 The Cellular Operator reviews the deployment design.**
- 6** The site planning engineer uses information from the simulation and the customer information form to prepare a preliminary design and equipment list.
- 7** The preliminary design, preliminary equipment list, and Meridian Configurator are used to prepare a preliminary design report and quote for the customer.
- 8** When the customer accepts the quote, the site planning engineer makes a site visit with deployment tools to take accurate RSSI readings and perform detailed deployment and provisioning, including placement of AFP stations. As an alternative, the Distributor may purchase this service from Nortel.
- 9** The site planning engineer prepares a final equipment list and detailed design documents for the Microcellular system installation and maintenance.
- 10 The Cellular Operator reviews the deployment design and commits to provide needed channels.**
- 11 *If necessary, the site planning engineer redesigns the Microcellular system deployment until the Cellular Operator approves the design.***
- 12** The final design and pricing information are provided to the customer for a purchase decision.

Figure 94 illustrates this deployment process.

Figure 94
Microcellular deployment process



Site planning and deployment alternatives

Site planning and deployment can be done by Nortel Authorized Distributors or the Cellular Operator provided that proper training is given. The Distributor can also hire Nortel Radio Frequency (RF) Engineering Services as a sub-contractor to provide these services:

- Microcellular Design and Deployment Service
- RF Commissioning
- Technical Support

For more information on obtaining these services from Nortel, contact Nortel's RF Engineering Service group.

Installation

Microcellular system installation

Before installing a Microcellular system, be sure that the Meridian 1 system meets all necessary prerequisites, including X11 Release R22 or later, a "C" processor, and MAT 5.

Table 33 gives some highlights of Microcellular installation procedure.

Table 33
Highlights of Microcellular installation procedure

Distributor	Cellular Operator
Install PC hardware, MSM PC software (MAT, MSM, AFP). Using the MAT Navigator, define a new system and configure communication parameters, etc. for it.	Install PC hardware, CMCP PC software (MAT, CMCP, Heartbeat) and alarm device (e.g., printer).**
Install hardware (MISP*, EIMC(s), MBS(s), Radios, Antennas, AFP Stations).	
Configure dial-in access for the CMCP and provide access information to the Cellular Operator (i.e., DN, User ID, Password).	
	Using the MAT Navigator, define a new system and configure communication parameters.
Configure buffer box to deliver Alarms and OMs to the Cellular Operator.	
Using the MSM, configure components (MISP*, EIMC(s), MXC(s), Cells, MBS(s), AFP Stations, etc.).	
	Using the CMCP, adjust/configure parameters.
	Provide list of portable MIN/ESNs and directory numbers for alarm/OM notification to Distributor.
Configure portables with MIN/ESNs provided by Cellular Operator.	
Enable Microcellular components.	
Jointly test and tune system to ensure proper operation.	
Monitor Alarms and OMs to maintain quality of service.	

The detailed procedure for installing a Microcellular system follows.

1 Microcellular software installation on the Meridian 1 system

- a** The Distributor installs/upgrades Meridian 1 software which includes Microcellular packages and, optionally, the Multi-Site networking package.

For details, see the *Nortel CCOMPANION Microcellular Installation guide (553-3611-200)*.

2 If needed, installation of a Meridian Administration Terminal (MAT), including installation of Mobility System Management (MSM) software and configuration and verification of the communications link between the Meridian 1 system and the MAT, following instructions in the MAT documentation:

- a** The Distributor installs a MAT PC, if necessary, ensuring that the security device is installed on the parallel port.
- b** The Distributor installs MAT software onto the MAT PC, following instructions that come with the software.
- c** The Distributor connects the hardware between the MAT PC and the Meridian 1 system.
- d** The Distributor installs the Mobility System Management (MSM) application on a MAT, following instructions that come with the software.
- e** The Distributor adds the Meridian 1 system to the MAT software and configures MAT access to the system.
- f** The Distributor selects and enables the Microcellular application, the Microcellular AFP application and the Station Administration application through the Applications page on the MAT Navigator Site property sheet.
- g** The Distributor configures and verifies the communication link between the Meridian 1 system and the MSM MAT.
- h** Synchronize PC with the Meridian 1 system by invoking Update System Data via the System Window.

For details, see the *Meridian Administration Tools MAT 5 Common Services User guide (P0867952)*.

- 3 Microcellular CMCP application installation on a PC.
 - a **The Cellular Operator installs a physical modem (PPP) for the CMCP to connect to the Meridian 1 system.**
 - b The Distributor, if needed, installs and configures a modem (PPP) connection to a Meridian 1 port for the CMCP to use.
 - c The Distributor provides dial-in access information to the cellular operator (modem DN, user ID and password).
 - d **The Cellular Operator installs a MAT PC and ensures that the security device is installed on the parallel port.**
 - e **The Cellular Operator installs the Microcellular CMCP application on the PC.**
 - f **The Cellular Operator adds the Meridian 1 Microcellular system to the CMCP software via the MAT Navigator window.**
 - g **The Cellular Operator enables and selects Communications Profile through MAT Application Property Sheet.**
 - h **The Cellular Operator verifies the dial-in link to the Meridian 1 system from the CMCP by connecting to Meridian 1.**
 - i **Optionally, the Cellular Operator sets up a device to view Microcellular alarms and operational measurements. (See “Buffer box implementation” section.) the Cellular Operator provides directory number(s) to the Distributor for alarm/OM notifications.**

For more information, see “Configure maximum number of portables”.

- 4 Hardware installation at the Microcellular site
 - a The Distributor installs Microcellular Base Stations, including TRU-II radios.
 - b The Distributor installs the antenna structure: coaxial cables, hybrids, and antennas.
 - c The Distributor installs AFP Station(s).
 - d The Distributor tests the RF coverage of the antenna structure. **(The Cellular Operator may want to be present for testing.)**
 - e The Distributor installs Microcellular cards in the Meridian 1 system.
 - f Optionally, the Distributor may install a buffer box and configure directory number(s) to forward alarms and OM's to the Cellular Operator.

For details, see the *Nortel COMPANION Microcellular Installation guide (553-3611-200)*.

- 5 Microcellular component configuration from the MSM MAT and the CMCP
 - a The Distributor connects to the Microcellular Meridian 1 system through the MSM MAT.
 - b The Distributor configures the Meridian 1 MISP, EIMC, and MXC cards, in order.
 - c The Distributor and the Cellular Operator configure the Microcellular zones, cells, MBSs and radios:

The Distributor adds and configures at least one zone through the Zone Object Manager window.

The Distributor adds and configures at least one cell through the Cell Object Manager window.

The Distributor configures the MBSs and radios:

The Distributor adds and configures at least one MBS for each cell.

The Distributor adds, configures, and unlocks at least two TRU-IIs for each cell.

The Distributor adds and configures at least one AFP Station through the AFP Region Object Manager window.

- d** Manual or automatic configuration of traffic frequencies and external cells

Option 1: Seed traffic frequencies and manual program external cells

The Cellular Operator adds external cells.

The Cellular Operator configures neighbor cells.

The Cellular Operator completes zone and cell configurations, including control and voice frequencies and enabling AFP voice channel for cells through the Frequencies Tab on the Cell Property Sheet.

The Cellular Operator configures AFP Region parameters.

The Distributor unlocks AFPRegion.

The Distributor unlocks each zone and then the cell or cells within the zone.

Option 2: AFP picks traffic frequencies and manual program external cells

The Cellular Operator adds external cells.

The Cellular Operator configures neighbor cells.

The Cellular Operator completes zone and cell configurations, including enabling AFP voice channel for cells but not entering voice frequencies through the Frequencies Tab on the Cell

Property Sheet.**The Cellular Operator configures AFP Region parameters.**

The Distributor unlocks the AFP region and waits for “convergence”, a stage in which AFP has generated a set of stable frequencies. Convergence can take from 30 minutes to three days, depending on AFP parameters set via the CMCP.

The Distributor unlocks each zone and then the cell or cells within the zone, once channels appear on the frequency page(s) of the cell manager(s).

Option 3: Seed traffic frequencies and AFP configures external cells

The Cellular Operator completes zone and cell configurations, including control and voice frequencies and enabling AFP voice channel for cells through the Frequencies Tab on the Cell Property Sheet.**The Cellular Operator configures AFP Region parameters.**

The Distributor unlocks AFPRegion.

The Cellular Operator waits for external cells to be automatically configured.**The Cellular Operator configures neighbor cells.**

The Distributor unlocks each zone and then the cell or cells within the zone.

Option 4: AFP selects traffic channels and configures external cells

The Cellular Operator completes zone and cell configurations, including enabling AFP voice channel for cells through the Frequencies Tab on the Cell Property Sheet but not entering voice channels.**The Cellular Operator configures AFP Region parameters.**

The Distributor unlocks AFPRegion.

The Cellular Operator waits for external cells to be automatically configured.**The Cellular Operator configures neighbor cells.**

The Distributor unlocks each zone and then the cell or cells within the zone, when “convergence” is reached.

- 6 Portable configuration (can be done while waiting for “convergence” and/or automatic configuration of external cells)
 - aThe Cellular Operator specifies maximum number of portables.**
 - bThe Cellular Operator selects encrypted ESN option, if desired.**
 - cThe Cellular Operator provides the portable Mobile Identification Numbers (MINs) and Electronic Serial Numbers (ESNs)**
 - dThe Distributor configures the portables using the Mobile Identification Numbers (MINs) and Electronic Serial Numbers (ESNs) provided by the Cellular Operator.**
- 7 Installation verification (initial installation)
 - a The Cellular Operator and the Distributor commission the Microcellular system (e.g. setting uplink and downlink power levels and making sure that antennas are pointing correctly).*
 - b The Cellular Operator and the Distributor test call placement and reception.*
 - c The Cellular Operator and the Distributor perform RF optimization (e.g. testing reselection and call handoff for multiple cells and adjusting pertinent parameters).*
 - d The Cellular Operator and the Distributor troubleshoot any portable problems.*
 - e The Cellular Operator and the Distributor test Microcellular interference outdoors.*

A laptop CMCP is recommended for adjusting RF parameters at the customer site during installation verification stage.

Installing the CMCP

The CMCP software runs on an IBM-compatible Pentium or better system running Microsoft® Windows™ 95 and MAT 5.7 or later software. The CMCP connects to a Meridian 1 system via a serial port or Ethernet connection. The serial port connection is usually through a modem (PPP), but the CMCP can be connected locally using an Ethernet interface.

Installing the CMCP requires the following tasks:

- 1** Install a CMCP PC.
 - a** Prepare a network plan and hardware list. This helps you to visualize the network layout and to prepare all required hardware for the installation.
 - b** Assign IP address for the CMCP PC and obtain IP address for the Meridian 1 system from the Distributor.
 - c** Backup data and applications using backup software (if not a dedicated machine)
 - d** Perform a virus check on your hard disk
 - e** Install and configure the communications hardware (i.e. Network Interface Card or Modem)
 - f** Install Windows 95 (if needed), Microsoft TCP/IP and dial-up adaptor
 - g** Connect the network and/or serial communications cables
 - h** Verify network and/or serial communications connections (Meridian 1-to-PC)
 - i** Configure a modem (PPP) connection for the CMCP PC to connect to the Meridian 1 system. (See the *Meridian Administration Tools Common Services User guide* (A0658266).)
 - j** Install the MAT 5 software onto the PC
 - k** Configure the CMCP PC
 - l** Verify MAT 5 operation at the PC
 - m** Configure the MAT 5 database and set definitions of your site and system

- 2 Install the Microcellular CMCP application on the PC from diskettes by following the instructions for installing and enabling applications in the *Meridian Administration Tools Common Services User guide* (A0658266).
 - a Click the yes button when prompted whether to install the Heartbeat application, if you want it to be run on the CMCP PC being installed.
- 3 Select and enable the Microcellular application and the Microcellular AFP application on the CMCP PC.
- 4 Add the Meridian 1 Microcellular subsystem to the CMCP software. (See “ Adding a Microcellular system”.)
- 5 Enable and select Communications Profile through the MAT Application property sheet.
- 6 Verify the dial-in link to the Meridian 1 from the CMCP. (See the *Meridian Administration Tools Common Services User guide* (A0658266).)

Microcell commissioning

During system commissioning, transmit power adjustments are performed to ensure that proper RF coverage exists within the building, while keeping outside emissions as low as possible.

Downlink power adjustment

Downlink refers to the RF link from the Microcell Base Station to the portable. The Microcell system should have been designed with downlink signal strengths equal to -85 dBm or 17 dB above the noise floor, whichever is the worst case. When the Microcell is turned up, a stronger signal strength is usually observed. This is caused by a conservative design link budget and by a form of diversity created by composite coverage from multiple antennas. Because of the increased coverage, the power level will need to be adjusted to provide optimal indoor coverage with minimal outdoor emissions.

The downlink coverage is adjusted by using the MAXTXPOW parameter in the radio debug mode. MAXTXPOW determines the output power at the TCM RF output ports on the rear of the MBS unit. During the design process, this was assumed to be 12 dBm. The actual maximum value of MAXTXPOW is 15 dBm. 12 dBm was used in the design process to allow for any needed adjustments when the system was turned-up.

An initial value for MAXTXPOW should be chosen using a link budget. A link budget takes into account the gains and losses within the RF system, and can be used to estimate the RF power at each of the Microcell antennas. This is completed by subtracting the hybrid (if applicable) and coax losses from the MBS output RF power for each antenna cable.

If 0 dBm was used as the test transmitter power level, then the initial value for MAXTXPOW should be chosen to achieve 0 dBm out of as many coax cables as possible.

Example 1

The following installed system was designed with a 0 dBm RF power level output from the antenna end of the cables. The system uses 0.5 inch coax, and a 4-port Hybrid. The following table shows effective radiated power (ERP) at each antenna with MAXTXPOW set to 15 dBm:

Table 34
Effective radiated power

Antenna	Cable Length	Hybrid and Cable Loss	Power into Antenna
1	100	5 dB	10 dB
2	200	7 dB	8 dB
3	250	8 dB	7 dB
4	300	9 dB	6 dB
5	250	8 dB	7 dB

The above table shows that the actual cable output powers are much higher than the 0 dBm used when designing the system. A good practice for picking an initial MAXTXPOW would be to decrease the MAXTXPOW from 15 dBm until the longest cable run output power is 0 dBm. In this case, we would decrease MAXTXPOW 6 dBm, or to a value of 9 dBm.

After setting an initial value, adjustment of MAXTXPOW should be completed by measuring the downlink signal strength with a test receiver. Measurements should be made throughout the Microcell coverage area and

outside the building. The collected data should be analyzed to determine if the coverage meets design requirements. This process should be repeated until the coverage meets the design requirements.

If it is not possible to adjust MAXTXPOW to meet outside emission requirements without creating coverage holes elsewhere, in-line attenuators may be used to attenuate "hot" antennas.

Uplink power adjustment

Uplink refers to the link from the portable to the MBS unit. In a Microcell system the uplink is much stronger than the downlink. This is because the portable (class IV) has the ability to transmit up to 600 mW, while the MBS can only transmit at 32 mW.

In a Microcellular system, the uplink and downlink paths should be kept as balanced as possible. This will ensure proper system operation and reduce outside building emissions as much as possible.

Once the downlink has been adjusted, the uplink will be adjusted to match the downlink. This is done by setting the TX power level of the portable. The uplink power is set by sending a portable power level to the portable. This power level tells the portable to attenuate its TX power a certain amount of 4 dB steps. The power levels and the related TX powers are shown in the following table:

Table 35
Portable Power

Portable Power Level	TX Power
2	27.8 dBm
3	23.8 dBm
4	19.8 dBm
5	15.8 dBm
6	11.8 dBm
7	7.8 dBm
8	3.8 dBm

Table 35
Portable Power

Portable Power Level	TX Power
9	-.2 dBm
10	-4.2 dBm

Using the value of MAXTXPOW, a portable power level should be determined from the above table. If the MAXTXPOW falls between two portable power levels, the lower portable power level should be used for single-cell Microcell systems. For multi-cell systems, the lower portable power level should again be chosen, and a parameter called TITO will be used to adjust for the small differences between uplink and downlink. (See the Hand-off optimization section for more details.) Note that accuracy of power levels 8, 9 and 10 can vary widely and care should be used if they are selected. (8= +-3 dBW, 9= +- 6 dBW, 10= +- 9 dBW), The other power levels do not have this variance.

Example 2

In example 1, we determined that the initial MAXTXPOW should be set to 9 dBm. If we assume that the final MAXTXPOW turns out to be 9 dBm, we can use the above table to determine that the portable power level should be set to 7 with the TITO parameter compensating for the remainder.

The portable power is data filled by setting VMAC/DMAC, MS_ACC_PWR, and Lowest Mobile attenuation to the desired level. These parameters are data filled via the CMCP on the Power sheet, under Cell Properties.

Desired power

The desired power level setting on a radio is determined as follows:

$$\text{Desired power} = \text{MAXTXPOW} - \text{TXPOWSTEP} \times \text{TXPOWIDX}$$

MAXTXPOW indicates the maximum transmit power setting (in dBm) possible for the given radio. TXPOWSTEP sets the current Modulating Power Amplifier power step size number (1.00 dB to 4.00 dB in 0.25 dB steps). TXPOWIDX sets the current power level attenuation number (0 to 7).

The radio has maximum output power when power level is set at “0” (no attenuation).

It is recommended to set TXPOWIDX to 0 and TXPOWSTEP to 0.

TRU-II radio setup

MAXTXPOW, TXPOWIDX, TXPOWSTEP and PATYPE are set via a monitor connecting directly to a TRU-II radio. You can operate the terminal interface in command-line mode or in full-screen monitor mode. The same basic commands are available in the command-line mode as well as in the full-screen mode.

Connect a VT100 terminal or a PC with a terminal application to the RS-232 port on the front panel of the TRU-II radio. By pressing the Break key on the terminal keyboard, you can gain access to the command-line mode. The terminal displays the following text:

```
TRU Terminal Interface
(C) Copyright 1990, 1991 Bell Northern Research, Inc.
>
```

To set the parameters from the command-line, enter the following:

```
>SET TXPOWIDX 0
>SET MAXTXPOW ###
>SET TXPOWSTEP 0
>SET PATYPE NONE
```

where: ### is the value selected for MAXTXPOW.

PATYPE NONE indicates that the power amplifier used is the internal power amplifier of the radio.

To enter the full-screen mode, type the following two commands at the command-line prompt (>):

```
>SET LT OFF           (disables the idle timer)
>SET FS ON
```

The SET FS ON command clears the existing display and invokes the full screen display. You type a command on the command line, at the > prompt,

and press the Return key to execute the command. You can execute only one command at a time.

If the TRU-II radio does not accept these commands from either the command-line mode or the full screen monitor mode, try disconnecting the twisted pair cable from the TRU-II radio. Then reconnect the twisted pair cable after the commands have been entered.

Microcell optimization

Once a Companion Microcellular system has been installed and commissioned, the radio frequency (RF) portion must be optimized. Optimization involves properly setting system parameters. These actions will increase voice quality, reduce system messaging, and ensure that the system is functioning properly. There are two steps in the optimization process: reselection optimization and hand-off optimization. These steps are briefly described below:

- Reselection occurs when a portable leaves or enters the Microcellular coverage area, or moves between cells covered by the Microcellular system. When the portable enters the Microcellular area, it needs to change (reselect) control channel frequencies from the macrocell control channel frequency to the Microcell control channel frequency. The reverse happens when the portable leaves the Microcell. Reselection optimization will assure that the portable reselects at the proper time and place.
- Hand-offs occur when the system requires more than a single cell to provide coverage to the site. (Note: The Microcellular system currently does not support hand-offs to the public macrocell system.) When a portable reaches the outer edge of a cell it needs to hand-off to another cell or call quality will decrease. Optimizing hand-offs will ensure good voice quality across the entire Microcell coverage area.

Reselection optimization

Reselection occurs when an idle portable moves between cells in a Microcellular system or enters or leaves the coverage area of the private Microcell. There are three types of reselection involved: macrocell to Microcell, Microcell to Microcell, and Microcell to macrocell.

Macrocell to Microcell

When a user enters into the Microcell coverage area the portable needs to reselect from the macrocell system to the Microcell system. This reselection can be controlled by either pointers in the macrocell neighbor lists or within the portable with Public Service Profile/Private Operating Frequencies (PSP/POF) functionality.

There are several possible scenarios in configuring macrocell to Microcell reselection.

- a. If the macrocell is not an IS-136 system (e.g. AMPS, CDMA and PCS-1900) PSP/POF portables are required for the Microcell.
- b. PSP/POF portables may also be used in an IS-136 system. If they are used, the macro neighbor cell pointer is not required.

Macrocell neighbor list

If the system is using a macrocell neighbor list, reselection will be controlled by the local Cellular Operator and not the Microcell system.

If the macrocell system is IS-136, the macrocell can configure the Microcell in their neighbor lists as either "regular" or "preferred" neighbor relationship. If it is a "preferred" relationship, the portable sees the Microcell control channel at a value greater than the `ss_suff` and reselects to the Microcell. If it is "regular", the portable reselects to the Microcell by the `RESEL_OFFSET` value. In either case, the portable user does not need to do anything. The reselection is automatic.

PSP/POF

PSP/POF allows the portable to be programmed with information about the surrounding macrocell, along with information about the Microcell system. When the portable enters the overlaying macrocell, it recognizes it is in the vicinity of its home microsystem and begins searching for the Microcellular system. This is a preferred neighbor relationship so once the portable sees the Microcell control channel at a value greater than `SS_SUFF`, it will reselect into the Microcell.

Once the Microcell system is active, a PSP/POF phone needs to be programmed. This is completed by performing a new system search from the phone. The phone will search the first strongest 24 cellular channels and find

any private system. When the phone finds a private system, it will query the user to select the system or keep searching. Once the user selects a system, the phone will attempt to register on that private system. If the registration is successful, the phone will initialize or modify its PSP/POF list by reading the neighbor list information on both the macro and micro. All reselection information will be included in these lists.

Within a multi-cell Microcell system, each cell needs to have every cell in the system defined as a neighbor. This will allow the phone to download all the private operating frequencies, making sure that the phone can reselect from the macrocell to any of the Microcell cells.

SS_SUFF is data filled on the Portable Access sheet under Cell properties. For information on Cell properties, see “Configuring and maintaining Microcellular systems” section. It should be set to the Microcell downlink threshold that is reached just upon entering the building. SS_SUFF is also the threshold for leaving the cell, so be careful not to set SS_SUFF too high or there may be points throughout the building where the phone will reselect to the macrocell. SS_SUFF is data filled as an integer and mapped to a RSSI value. (Please see the SS_SUFF Table in the appendix.)

Microcell to Macrocell

When the portable leaves the private Microcell coverage area, it will reselect from the private Microcell to the public macrocell. This neighbor cell relationship should be defined as a non-preferred reselection candidate. When the signal strength of the Microcell falls below the data filled SS_SUFF of the Microcell, the reselection process is triggered. If the macrocell signal strength is greater than the Microcell signal strength by RESEL_OFFSET, and greater than the macrocell's SS_SUFF, for a time equal or greater than DELAY, the portable will reselect to the macrocell.

The Microcell SS_SUFF parameter is data filled on the Portable Access sheet under Cell properties, as described in the macrocell to Microcell, PSP/POF section above.

Macrocell SS_SUFF is data filled on the Configuration sheet under External Cell properties. SS_SUFF is data filled as an integer and mapped to a RSSI value. (Please see the SS_SUFF Table in the appendix.) For information on External Cell properties, see “Configuring and maintaining Microcellular systems” section.

DELAY and RESEL_OFFSET are data filled on the Neighbor Cell Configuration screen. DELAY is in seconds and RESEL_OFFSET is data filled as an integer and mapped to a RSSI value. (Please see the RESEL_OFFSET table in the appendix.)

If there is poor macrocell coverage outside the Microcell coverage area, the RSS_ACC_MIN parameter should be used to force users off the Microcell system when they are outside the desired Microcell coverage area. This will keep users from originating calls with poor voice quality in areas with poor cellular coverage (micro or macro). RSS_ACC_MIN should be set at a value 5 dB below the lowest Microcell signal in the desired coverage area.

RSS_ACC_MIN is data filled on the Portable Access sheet under Cell Properties. RSS_ACC_MIN is data filled as an integer and mapped to a RSSI value. (Please see the RSS_ACC_MIN table in the appendix.) For information on Cell Properties, see “Configuring and maintaining Microcellular systems” section.

Microcell to Microcell (for multi-cell systems)

When the portable moves around a multi-cell Microcell system it needs to reselect between these cells.

When data filling internal Microcell neighbors they should be defined as regular reselection neighbors. This is done by setting Celltype to regular on the Neighbor Cell Configuration screen.

Once the neighbor lists are data filled, the portable will continually scan the neighbor cells. Because internal Microcell neighbors are data filled as regular reselection candidates, the portable only looks to see if the candidate cell is stronger than the serving cell by RESEL_OFFSET. Once this is met for a data filled delay, the portable will reselect to the candidate cell. The delay is used to prevent the portable from constantly reselecting between two cells (ping pong) when it is in an overlapping area.

RESEL_OFFSET should be set to -6 dB and adjusted if reselection is dragging or occurring too soon.

RESEL_OFFSET is data filled on the Neighbor Cell Configuration screen. RESEL_OFFSET is data filled as an integer and mapped to a RSSI value. (Please see the RESEL_OFFSET table in the appendix.) For information on

Neighbor Cell properties, see “Configuring and maintaining Microcellular systems” section.

Hand-off optimization

If a Microcellular system covers a large area or has many users, there may be a need to have multiple cells within the system. When a system has multiple cells, hand-offs between these cells will be needed.

Hand-offs allow the system user to make a call and travel around the system without ending the call. When the user approaches the edge of a cell, the system will tell the portable to hand-off to the adjacent cell.

The system makes the decision to hand-off the call from the RF signal levels on the uplink and downlink. When the uplink signal strength falls below a certain data filled value, hand-off threshold low (HOTL), the system triggers a hand-off request. Once a hand-off request is triggered, the system instructs the portable to take downlink control channel signal strength measurements of the candidate cells and the serving cell. If a candidate signal strength is greater than the serving signal strength plus a delta, it is a valid hand-off candidate. The system then takes the strongest of the valid candidates and instructs the portable to hand-off to that cell. If none of the candidate cells signal strengths are greater than the serving signal strength plus the delta, then system will instruct the portable to remain on the current cell. This type of hand-off is called mobile assisted hand-off (MAHO), because the portable makes the measurements that the hand-off is based on.

Hand-off neighbors are data filled from the Cells screen under the configuration menu. The following handoff parameters are configured via the CMCP.

Uplink RSSI Hand-off Threshold Low (HOTL)

This is the uplink signal strength at which the system will trigger a hand-off. HOTL should be set low enough to avoid signal fading and coverage lows between antennas within a cell, but not so low as to drag a call too far into a cell. Dragging a call can cause problems with voice quality and interference. If HOTL is set too high, there will be problems with too much messaging on the system caused by excessive handoff requests.

HOTL should be determined by measuring uplink signal strength at the cell boundaries. Uplink signal strength is measured by using a PC with a

communication program (e.g. Hyper Terminal) to connect to the TRU-II maintenance port. A call is then placed near the physical boundary of the cell, and data fill rssi' command is issued from the PC to read the uplink signal strength.

For single-cell Microcell systems, HOTL should be set to -125 dBm. This will disable hand-offs in the system.

HOTL is data filled on the Thresholds sheet under Cell properties. For information on Cell properties, see "Configuring and maintaining Microcellular systems" section.

HO Delta

The delta is the amount of RSSI by which a candidate has to be stronger than the serving cell to hand-off. The purpose of the delta is to keep the system from performing repeated hand-offs between two cells (ping-ponging) when a portable is at a cell boundary. This should be set to 3 dB and increased if ping-ponging occurs, and decreased if call dragging occurs. Every hand-off pair will have a delta that is data filled on the Configure sheet under Neighbor Cell properties. For information on Cell properties, see "Configuring and maintaining Microcellular systems" section.

RSSI Sample Rate

When the portable is instructed to report back the RSSI for the candidate and serving cells, it does so in 1 second samples. RSSI sample rate is the number of these samples that should be averaged before making a hand-off decision. RSSI sample rate should be set to 2. If there is a problem with hand-off ping-ponging, the value can be increased, but if its increased too much it will cause the call to drag. RSSI sample rate is data filled on the Power sheet under Cell properties. For information on Cell properties, see "Configuring and maintaining Microcellular systems" section.

ERP Delta

ERP delta is a value used to adjust for differences between the control channel TX power and voice channel TX power. The adjustment is needed because hand-off decisions are based on control channel measurements, but affect voice channels. In a Microcell system, this parameter should be set to 0, because there are no differences between the control channel and voice channel TX powers. ERP delta is data filled on the Power sheet under Cell

properties. For information on Cell properties, see “Configuring and maintaining Microcellular systems” section.

TCH Talk-in/Talk-out (TITO)

TITO is used to adjust differences between the uplink and downlink voice channel signal strengths. This should be used to adjust the differences between portable TX power and MBS TX power. TITO should be set to 0, 1, 2, or 3 dB, depending on the difference between the portable TX power and MBS TX power. TITO is data filled on the Power sheet under Cell properties. For information on Cell properties, see “Configuring and maintaining Microcellular systems” section.

The following table can be used to determine the proper value of TITO for a given MBS output power.

Table 36
Talk-in/Talk-out Values

MBS Output Power dBm	Portable Power Level dBm	TITO dB
15	5	0
14	6	3
13	6	2
12	6	1
11	6	0
10	7	2
9	7	1
8	7	0
7	8	3
6	8	2
5	8	1
4	8	0
3	9	3
2	9	2
1	9	1
0	9	0

Configuring and maintaining Microcellular systems

Before the initialization of a Microcellular system, the Cellular Operator configures the Microcellular heartbeat, completes the configuration of Microcellular zones and cells, and unlocks the Microcellular subsystem through the CMCP, and starts the heartbeat. While Microcellular systems operate, the Operator performs maintenance as needed to keep the systems operational and to monitor Microcellular voice and control channels.

The Cellular Operator performs the following tasks for each Microcellular system:

- 1** Add the Microcellular system.
- 2** Connect to the Microcellular system.
- 3** Configure maximum number of portables.
- 4** Launch and configure the Microcellular heartbeat application (optional).
- 5** Complete the Microcellular zone configurations.
- 6** Complete the Microcellular cell configurations.
- 7** Complete the AFP Region configurations.
- 8** Configure external cells (optional).
- 9** Configure neighbor cells.
- 10** Unlock the Microcellular subsystem.
- 11** Configure heartbeat parameters for each Microcellular system (optional).
- 12** Inform the Microcellular installer that the configuration is complete and assist with initialization.
- 13** After the installer unlocks the zones and cells, send the heartbeat to the Microcellular system.
- 14** Perform maintenance as needed to keep the Microcellular system operational and to prevent interference with the macrocellular system.
- 15** Monitor alarms and operational measurements

- 16** CMCP allows the Cellular Operator to shut-down the radio portion of the Microcellular system by locking a cell, a zone or the subsystem. Normal PBX operation will not be affected.
- a** Upon locking a cell (or a zone), all active wireless calls served by the radios within the cell (or the zone) are dropped and users cannot receive or initiate calls on their portables while in the coverage area of the cell (or the zone). Note that Distributors can place the cell (or the zone) back in service by unlocking the cell (or the zone) from a MAT located at the customer premise.
 - b** Upon locking the subsystem, all active wireless calls served by the Microcellular system are dropped and users cannot receive and initiate calls on their portables while in the coverage area of the Microcellular system. Note that Distributors **CANNOT** place the subsystem back in service: they cannot unlock a subsystem.

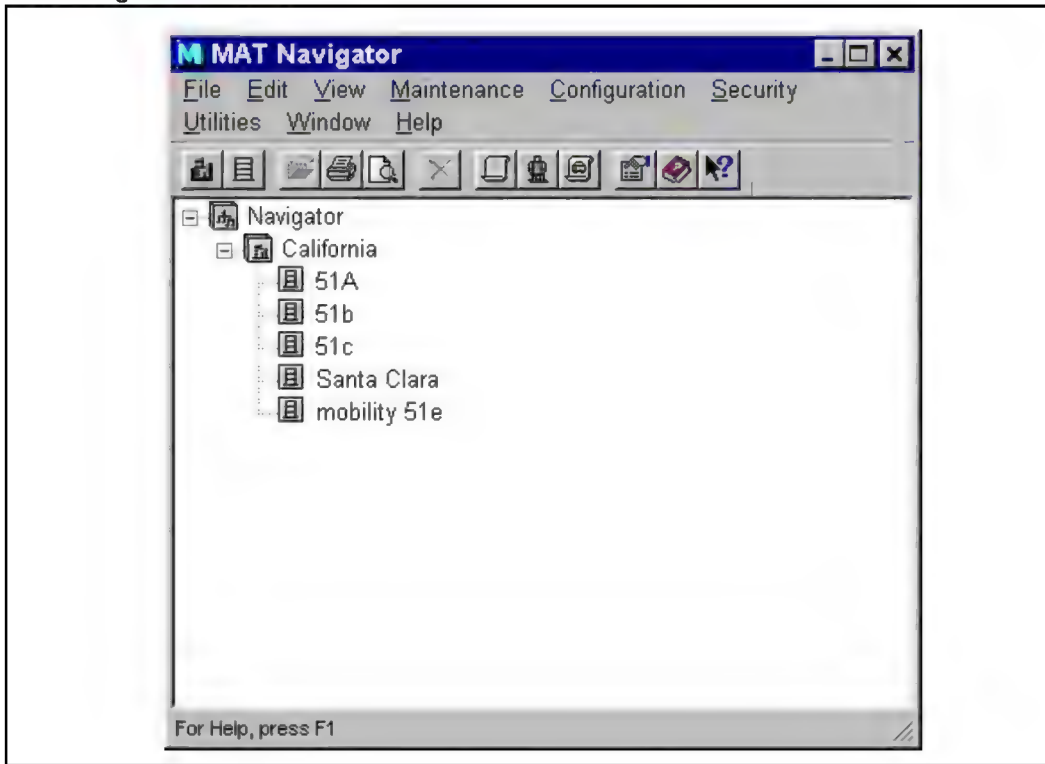
NOTE: Before locking a cell, zone, or subsystem, both the Distributor and the customer should be notified.

In the following sections, a shaded input area of a property sheet indicates that the associated parameter is read only.

Adding a Microcellular system

To add a Microcellular system, use the MAT Navigator to add the customer's Meridian 1 system to the CMCP and then use the property sheet pages to add system and connection information. Figure 95 shows the MAT Navigator window.

Figure 95
MAT Navigator window



Follow the instructions in the *Meridian Administration Tools Common Services User guide* (A0658266) for adding a Meridian 1 system. In general, you do the following:

- 1 In the Navigator window, select the desired site.
- 1 Choose Add System from the Configuration menu.
- 2 Enter the system information on the General page (name, phone number, and so on).
- 3 Enter the communications information on the Communications page.
- 4 Configure the Meridian 1 information on the System Data page.

- 5 Enable desired applications on the Applications page. This opens a MAT System window for the Microcellular system.

Connecting to a Microcellular system

The Distributor should be informed before connecting CMCP PC to a Microcellular system.

To configure Microcellular components, first connect the CMCP PC to the Microcellular system through the MAT Navigator window:

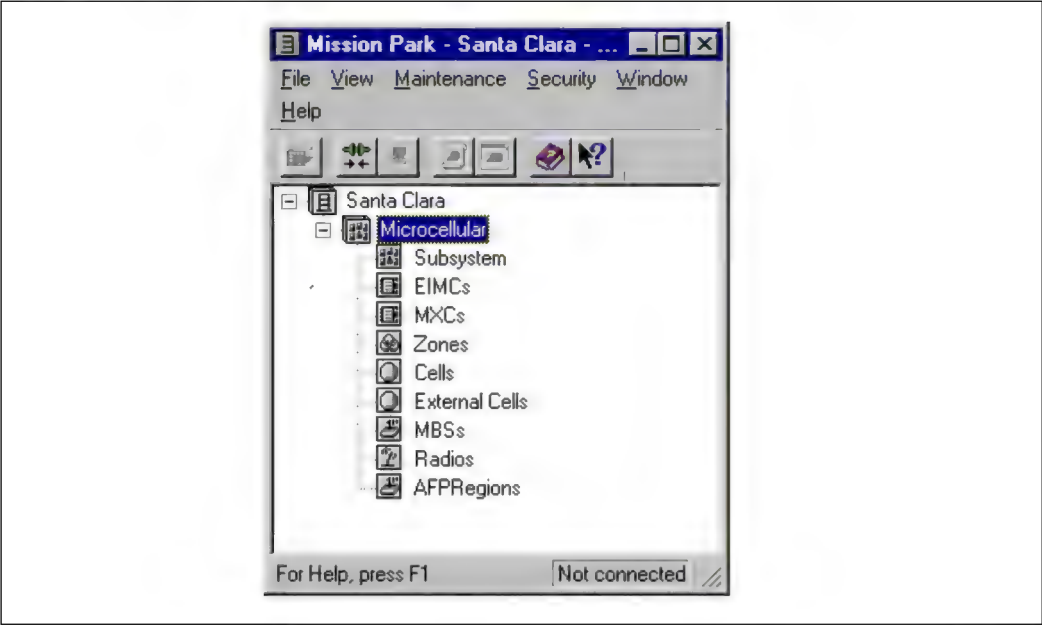
- 1 To start the MAT software, select **MAT** in the Windows 95 **Programs** list.
- 2 In the MAT login dialog box, enter your MAT user ID and password and click **OK**.

The MAT Navigator window appears. It contains icons that represent Microcellular sites. You can expand the tree to display systems within each site.

For more information about the Navigator window, see the *Meridian Administration Tools Common Services User guide* (A0658266).

- 3 Double-click the icon of the Microcellular system, or highlight the Microcellular system and select **Open** from the **File** menu.
- 4 Double click an object to select the object.
- 5 In the Meridian 1 login dialog box, enter your Meridian 1 user ID and password (provided by maintenance provider).
- 6 This opens a MAT System window for the Microcellular system (see Figure 96).

Figure 96
MAT System window



The system window gives you access to the Microcellular management application, as Figure 96 shows. The object manager icons in this window represent the Microcellular subsystem within the Meridian 1 system. You can use the object managers to add, configure, and unlock Microcellular components, where appropriate and allowed.

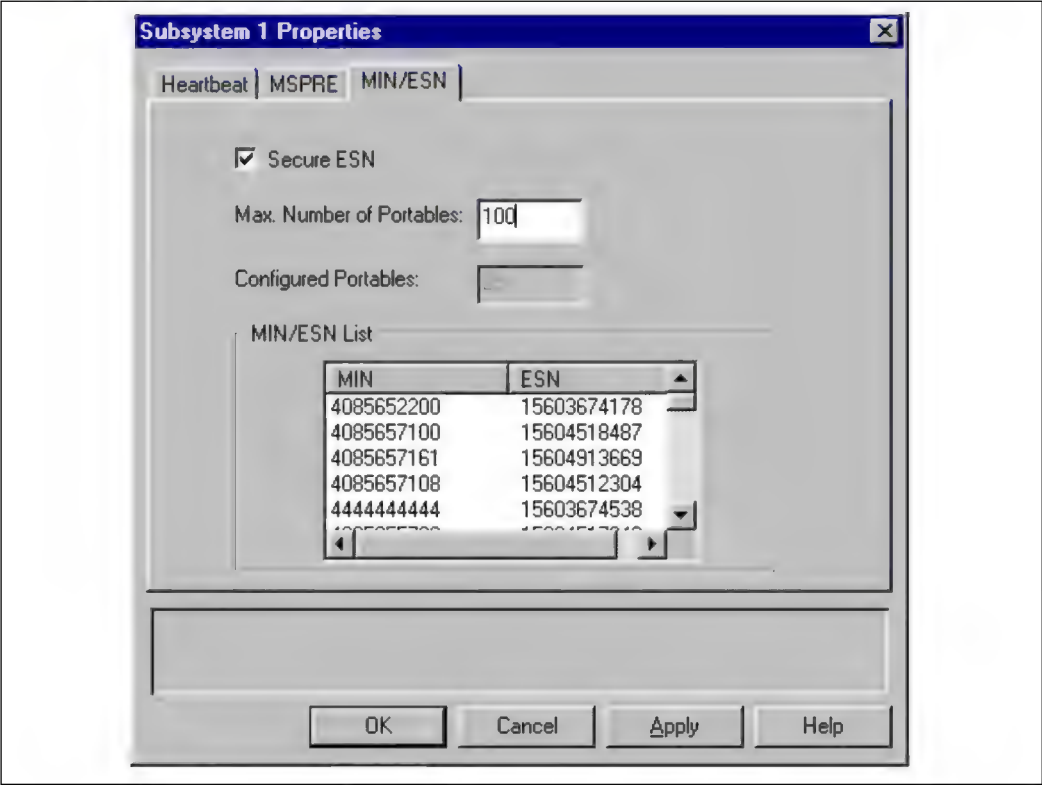
Configure maximum number of portables

Use the Subsystem Object Manager to configure MIN/ESN properties for the Microcellular system. Perform the following procedure:

- 1 In the System window, double-click the Subsystem icon to open the Subsystem Object Manager window.
- 2 Choose Properties from the Configuration menu. This opens the Subsystem property sheet.
- 3 Click the MIN/ESN tab to view the MIN/ESN property page, which Figure 97 illustrates.

The attribute values for Configured Portables and MIN/ESN List are view only on the CMCP.

Figure 97
MIN/ESN property page



- 4 Select Secure ESN if you want encrypted ESNs to be displayed on the Distributor's MSM. Otherwise, the actual ESNs will appear on the MSM. The actual ESNs are always displayed on the CMCP regardless of the mode of the Secure ESN flag.
- 5 Enter the attribute value for the MIN/ESN page:

Max. Number of Portables. The maximum number of portables allowed on the Microcellular system. Nortel recommends this parameter be set at least slightly above the number of portables requested by the customer to avoid extra administration work and delay in adding users. Default: 1500

Configuring Microcellular heartbeats

The heartbeat application is an optional feature. During installation of the CMCP, a window prompts you whether or not to install the Heartbeat application. Multiple CMCPs can be connected to a Microcellular system, however, the Heartbeat application can only be run on one CMCP PC. Click the yes button, if you want to run the Heartbeat application on the CMCP PC being installed.

The Heartbeat application depends on the Scheduler and the MAT (or CMCP) Navigator. You need to keep the Scheduler and the Navigator running at all times to enable Microcellular operations. You should keep the Heartbeat manager running as well to indicate status of all connected microcellular systems.

The Heartbeat application is not placed in the Windows 95 startup folder during installation. This means that you have to manually launch it upon a PC reboot. However, the MAT (or CMCP) Navigator and the Scheduler activate themselves after a PC reboot.

Heartbeat messages are sent via the Scheduler utility. Therefore, upon a PC reboot, which terminates the Heartbeat application, the Scheduler continuously sends the heartbeat message at the pre-configured time, and at once if the heartbeat is already due. This implies that the CMCP automatically performs a heartbeat on all configured systems even in the case that an extended power failure causes the PC to restart.

If the heartbeat is enabled for a Microcellular Meridian 1 system, the system expects a "keep-alive" heartbeat message at certain intervals. After three

missed heartbeats, the Microcellular system automatically locks the subsystem. When the Microcellular subsystem is locked, none of the cells are active and portable users cannot make or receive calls. To recover from this, you can unlock the subsystem from the CMCP and then set up the regular heartbeat messages again.

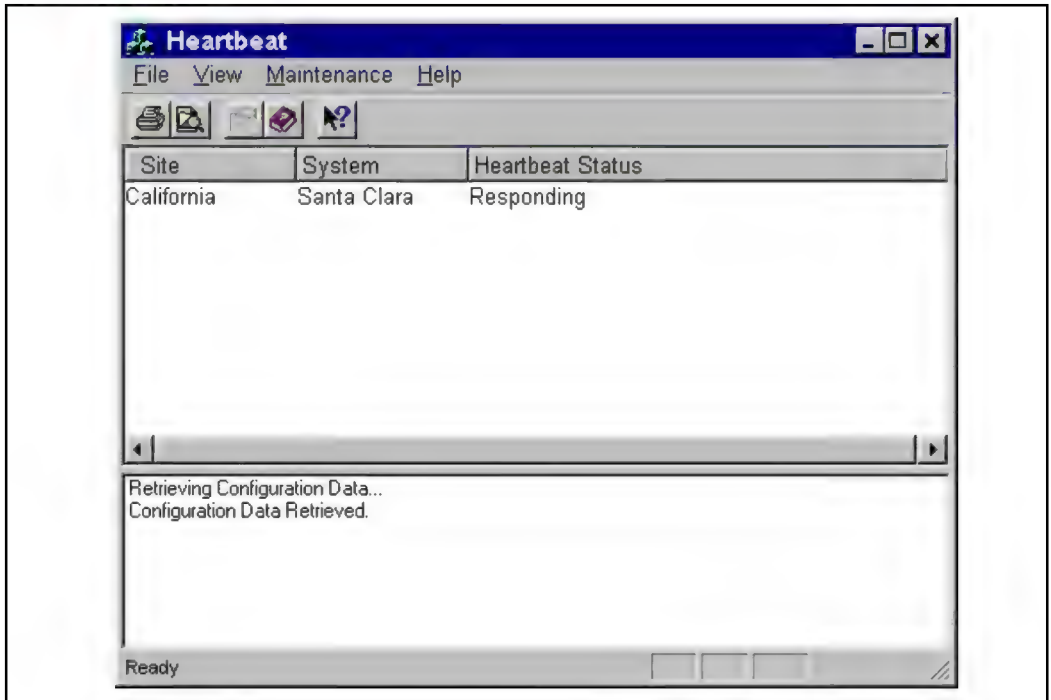
Typically, the CMCP is connected via a modem to the PSTN, and the Meridian 1 switch also has a modem to the PSTN. Since modem connections are occasionally unreliable, the CMCP modem needs to retry connections to send the heartbeat messages.

Note that the CMCP must run 24 hours a day if the heartbeat application is used.

Start the Heartbeat application

To start the Heartbeat application, select the Heartbeat icon from the Programs list in the Start menu. Figure 98 shows the Heartbeat window.

Figure 98
Heartbeat window



Any Meridian 1 systems that you configure on the CMCP show up in the system list, which displays the names of the Microcellular site and Meridian 1 system and the status of the heartbeat.

System list updates

Any Meridian 1 systems that you configured in the MAT Navigator window will show up in the list view of the Heartbeat manager when the heartbeat application is running.

If you add a new Meridian 1 system while the Heartbeat window is open, the new system does not show up in the list. To update the system list, choose Refresh System List from the Maintenance menu.

Heartbeat application maintenance

Whenever the CMCP reboots, the Heartbeat application needs to be relaunched. The CMCP's heartbeat function runs after the launch, even when the Heartbeat window is close. However, you need the Heartbeat window to view Heartbeat status of all Microcellular systems. Thus, it is recommended that the Heartbeat window be open at all times to indicate status of Microcellular systems.

Any Microcellular systems relying on the heartbeats will shut down after the third missed heartbeat to that Microcellular system.

Scheduler application maintenance

The Heartbeat application depends on the Scheduler program, which runs in its own window to execute actions at certain times. The Heartbeat application uses the Scheduler to send Microcellular heartbeats.

Keep the Scheduler application running at all times on the CMCP to enable Microcellular operations.

Heartbeat parameter configuration

You can configure the heartbeat attribute values for a Microcellular system after you unlock the subsystem. For information about configuring these parameters, see “Configuring heartbeat parameters” on page 383.

Heartbeat Status

The heartbeat window displays a Heartbeat Status value for every Microcellular Meridian 1 system:

Not Configured	The heartbeat is disabled.
Responding	The Microcellular system received the last heartbeat.
1st Heartbeat missed	The Microcellular system did not receive one heartbeat.
2nd Heartbeat missed	The Microcellular system did not receive two consecutive heartbeats.
Not Responding	The Microcellular system did not receive three consecutive heartbeats.

If the status is 1st or 2nd Heartbeat missed, check the CMCP modem and software to see if the CMCP failed to send the heartbeat. If the CMCP is operating correctly, contact the Microcellular customer to help determine the reason for the missed heartbeat.

If the CMCP sends the Heartbeat message successfully to the Microcellular system and receives an acknowledgment of the message sent, the count of heartbeat messages missed is reset to zero.

If the status is Not Responding, the Microcellular system automatically shuts the subsystem down by locking the subsystem object. Take action immediately to restore Microcellular operations:

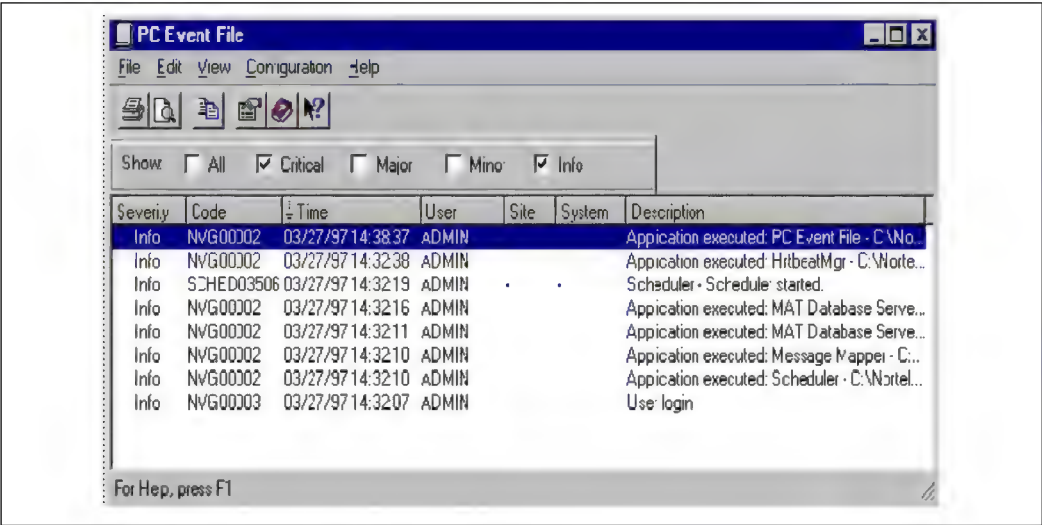
- 1** Check the CMCP modem and software to see if the CMCP failed to send the heartbeats.
- 2** If the CMCP is operating correctly, contact the Microcellular customer to help determine the reason for the missed heartbeats.
- 3** When the Microcellular system is ready, unlock the subsystem to restore operations and send the heartbeat immediately. (See “Sending a heartbeat immediately” on page 385).
- 4** View the Heartbeat property sheet for the Microcellular Meridian 1 system, from the Heartbeat application or from the Subsystem Object Manager for the system, to determine the time interval before the next heartbeat message.
- 5** After the heartbeat time interval, check the Heartbeat Status value to confirm that the Microcellular system received the next heartbeat message.

If the Microcellular system continues to not respond, work with the customer until the problem is resolved.

Heartbeat message monitoring

The time of the last heartbeat can be obtained from the PC events log. Select PC Events from the Maintenance menu in the MAT Navigator window. Figure 99 shows the PC Event File window.

Figure 99
 PC Event File



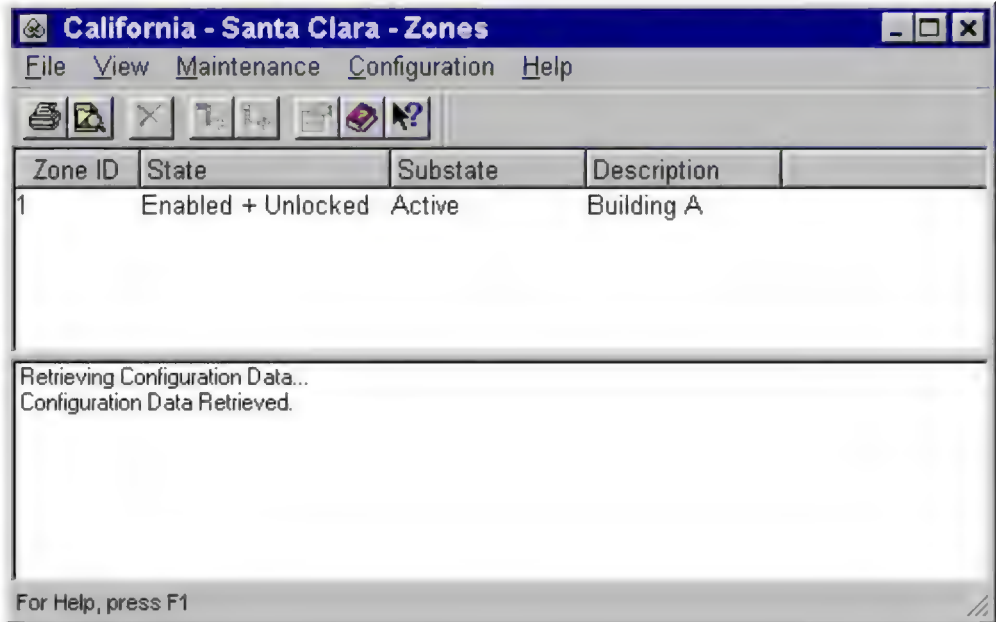
Completing zone configurations

The Microcellular system supports IS-136 and IS-54B protocols. However, Nortel recommends an IS-136 solution for optimal system performance. This section shows all zone property sheets for the IS-136 configuration.

To complete the configuration of a zone object, perform the following procedure:

- 1 In the System window, double-click the Zones icon to open the Zone Object Manager window, which Figure 100 illustrates.

Figure 100
Zone Object Manager window



- 2 Highlight a zone in the object list and choose Properties from the File menu. The object manager opens the Zone property sheet.

Figure 101 illustrates the Zone property sheet for the IS-136 protocol.

Figure 101
IS-136 Zone property sheet

ZONE 1 Properties

Configuration

EIMC ID: 1

Description: LOADING 4

Macro System ID: 31

RNUM: 77

OK Cancel Apply Help

3 Configure the following zone attribute values:

Macro System ID A 15-bit System ID (SID) assigned to each U.S. macrocellular system by the FCC. Each mobile station stores this ID to identify the station's home system.

Example: 31

RNUM A 10-bit registration number for a zone. When a portable reselects between two zones that have different RNUMs, the portable will be forced to register. This will allow system messaging for a portable to be isolated to the zone it is currently in. A unique RNUM should be set for each zone in a multi-zone system. RNUM values range from 0-1023 of the VMLA.

Example: 77

When a portable registers in the zone, it stores the RNUM in a list of RNUM values. If the portable camps on to a digital control channel that broadcasts an RNUM not in its stored list, the portable registers in the new zone.

4 Click OK to enter the zone attribute values and return to the Zone Object Manager window.

The object manager list box displays information about all the zones in the Microcellular system, including the attribute values. If you need to change an attribute value for a zone, you can highlight the zone in the list box and choose Properties from the File menu to open the property sheet again. Button 2 on the mouse also opens the property sheet.

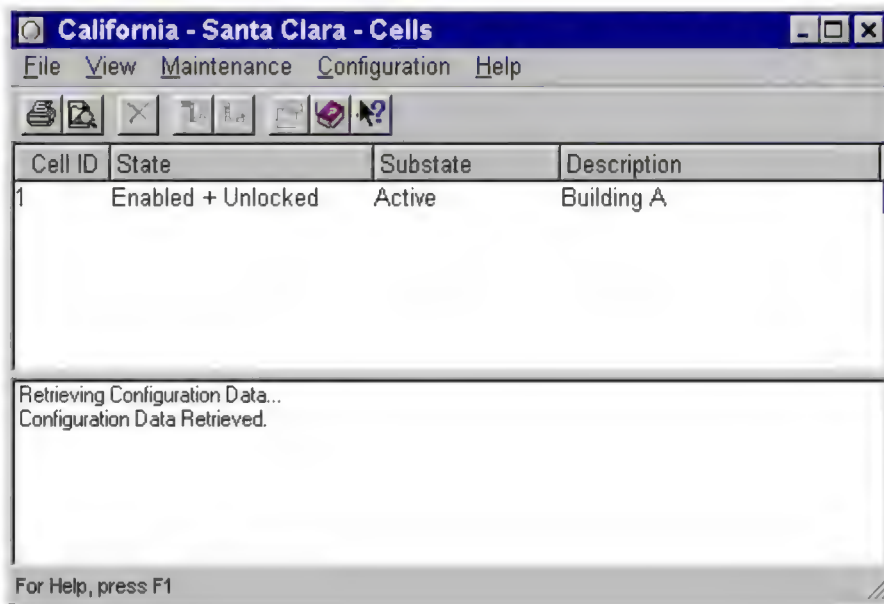
Completing cell configurations

The Microcellular system supports IS-136 and IS-54B protocols. However, Nortel recommends an IS-136 solution for optimal system performance. This section shows all cell property sheets for the IS-136.

To complete the configuration of each cell object, perform the following procedure:

- 1 In the System window, double-click the Cells icon to open the Cell Object Manager window, which Figure 102 illustrates.

Figure 102
Cell Object Manager window



Highlight a cell in the object list and choose Properties from the File menu. The object manager opens the Cell property sheet.

Figure 103 illustrates the Configuration page on the Cell property sheet for the IS-136 protocol.

Figure 103
IS-136 Cell property sheet, Configuration page

The screenshot shows a Windows-style dialog box titled "Cell 1 Properties" with a close button (X) in the top right corner. The dialog has a tabbed interface with four tabs: "Portable Access", "Thresholds", "Frequencies", and "Configuration". The "Configuration" tab is currently selected. Inside this tab, there are four sub-tabs: "Configuration", "Color Codes", "Power", and "Registration". The "Configuration" sub-tab is active, displaying several input fields for cell configuration:

- Zone ID:** A small text box containing the number "1".
- Description:** A larger text box containing the text "Building A".
- Protocol:** A dropdown menu currently showing "IS-136".
- System operator code:** A text box containing the number "1".
- PSID:** A text box containing the number "12277".
- AlphaPSID:** A text box containing the text "Building A".

At the bottom of the dialog, there is a large empty rectangular area and four buttons: "OK", "Cancel", "Apply", and "Help".

- 2
Enter the following Configuration attribute values for the cell on the Configuration property page:
- System operator code
,Your system operator code (1-2047, 2049-4095).

This code is assigned to the Cellular Operator by TIA45.3, the subcommittee that developed IS-136. The system operator code is a superset of SIDs. Refer to IS-136 revision 0, Annex B “SOC and BSMC Assignments.”

Example: 1
- PSID

A numeric private system ID in the range 0 to 32767 that you assign to the Microcellular system.

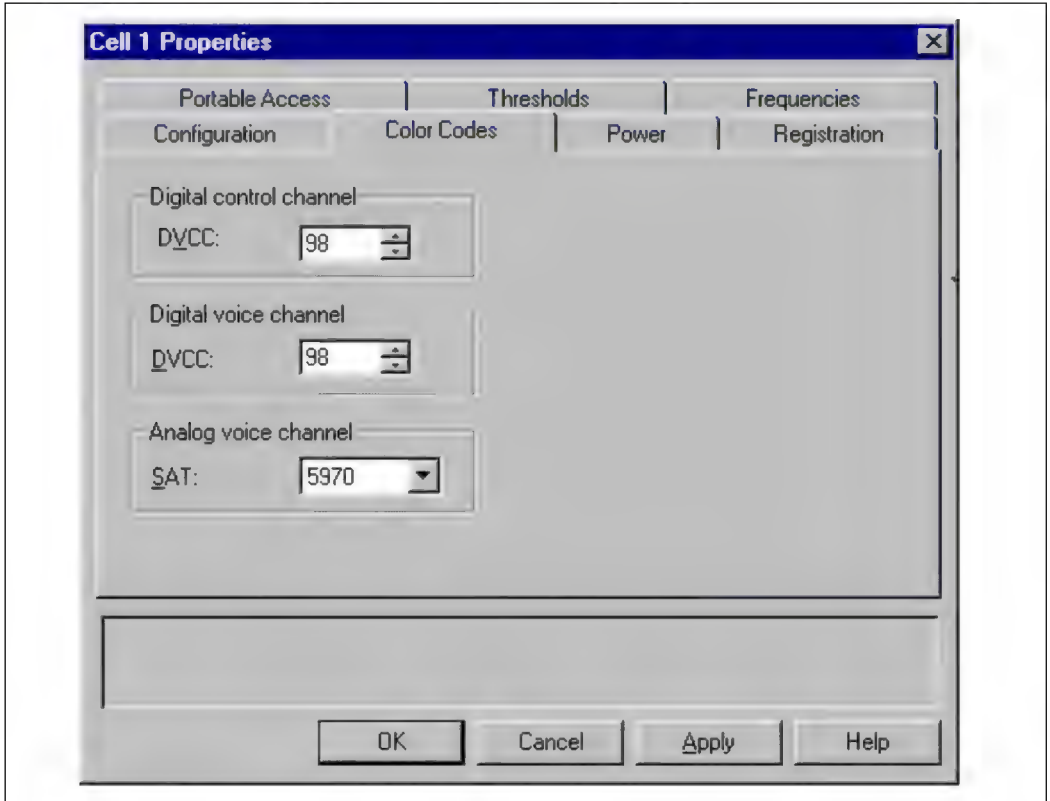
Example: 12287
- Alpha PSID

An alphanumeric private system ID up to 15 characters long. This Alpha PSID will appear on the display of the Microcellular user’s portable, with PSP/POF capability, when it is camping on the Microcellular system.

Example: Building A
- You can click Apply to save the Configuration attribute values.

- 3 Enter the Color Code attribute values for the cell. Figure 104 illustrates the Color codes page on the Cell property sheet for the IS-136 protocol.

Figure 104
IS-136 Cell property sheet, Color Code page



DVCC (DCCH) An 8-bit Digital Verification Color Code that the MBS sends to the portable to generate the CDVCC, which is used to distinguish the current traffic from the traffic co-channels. The Microcellular system generates the DVCC value automatically, but you can change the value to any integer in the range 1 to 255.
Default value: 99

DVCC (voice) An 8-bit Digital Verification Color Code that the MBS

sends to the portable to generate the CDVCC, which is used to distinguish the current traffic from the traffic co-channels. The Microcellular system generates the DVCC value automatically, but you can change the value to any integer in the range 1 to 255.
Default value: 8

SAT Analog Supervisory Audio Tone (SAT) color code to be added to an analog voice transmission by the base station. A mobile station must detect, filter, and modulate the transmitted voice-channel carrier with this tone. Values include 5970, 6000, and 6030.
Default value: 5970

You can click Apply to save the Color Codes attribute values.

4 Enter the Power attribute values for the cell.

Figure 105 illustrates the Power page on the Cell property sheet for the IS-136 protocol.

Figure 105
IS-136 Cell property sheet, Power page

Cell 1 Properties

Portable Access | Thresholds | Frequencies
 Configuration | Color Codes | **Power** | Registration

Mobile attenuation codes

VMAC/DMAC: 7

MS_ACC_PWR: 7

Lowest mobile attenuation: 7

Radio attenuation

Power Level:

☒ High

☐ Low

Handoff

ERP Delta: 0

ICH Talk in/Talk out: 0

BSSI Sample Rate: 2

OK Cancel Apply Help

VMAC/DMAC A 4-bit Voice Mobile Attenuation Code/Data Mobile Attenuation Code) that indicates the initial power attenuation level a portable is assigned when given service on a digital traffic channel. VMAC/DMAC values range from 0 to 10. Default value: 7

MS_ACC_PWR Defines the maximum nominal output power that a mobile station shall use when accessing the reverse digital control channel. Values range from 0 to 10.

Default value: 10

See ““RSS_ACC_MIN, SS_SUFF, MS_ACC_PWR and RELSEL_OFFSET Parameters” on page 391” for the corresponding signal levels in dBm.

Lowest allowed module attenuation.Traffic Channel Mobile Attenuation Code Minimum. Indicates the lowest attenuation level (maximum power) that a mobile station should transmit while in this cell. Values range from 0 to 7

Default value: 0

ERP Delta Effective Radiated Power (ERP) Delta. Specifies the difference, in dB, between the ERP of the TCH and the CCH. Values range from 0 to 10.

Default value: 0

TCH Talk in/Talk out Traffic channel Talk In Talk Out Specifies the difference, in db, between the MBS VCH RF receive level of the mobile station and the mobile’s RF receive level of the MBS for a class one mobile operating at the MAHO cell’s vMax. Values range from -15 to 15.

Default value: 0

RSSI Sample Rate The rate of sampling of MAHO measurements done by the DRU. Values range from 0 to 15.

Default value: 4

Power level Radio buttons to select MBS power level. This indicates the attenuation level at which an MBS transceiver should transmit. The TRU-II supports only High (0) and Low (3).

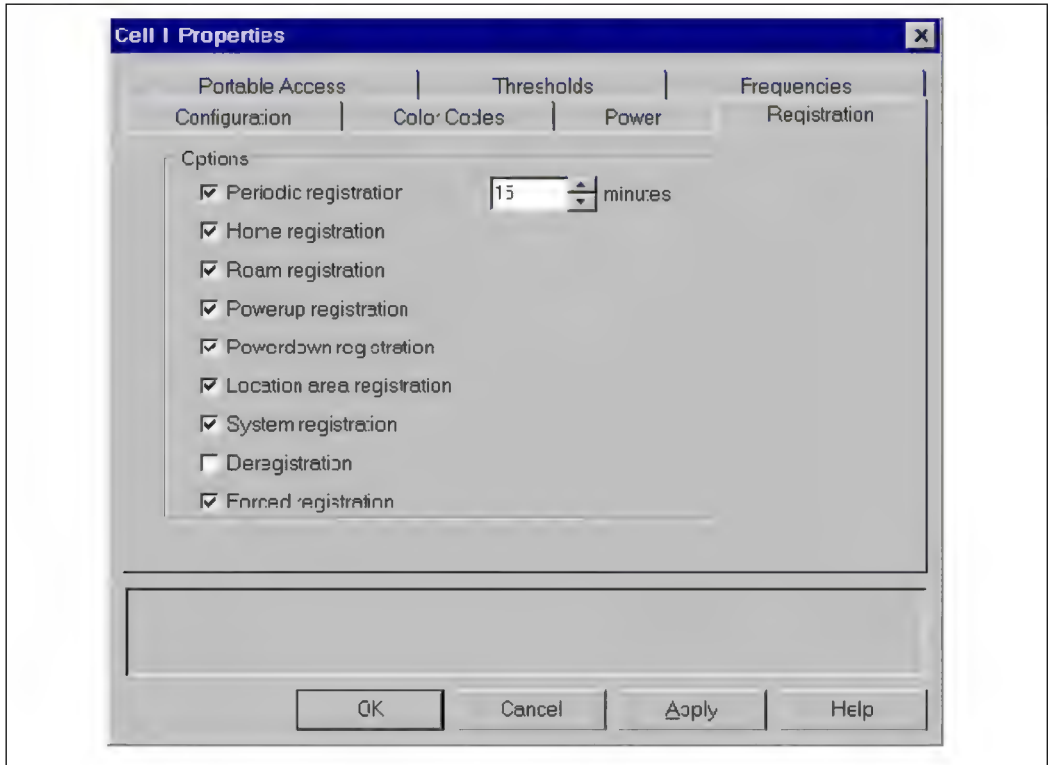
Default value: Low

You can click Apply to save the Power attribute values.

5 Enter the Registration attribute values for the cell.

Figure 106 illustrates the Registration page on the Cell property sheet for the IS-136 protocol.

Figure 106
IS-136 Cell property sheet, Registration page



Periodic registration. Indicates if Periodic Registration is active.
Default value: Enabled

Periodic registration period. Minutes between autonomous registrations by a mobile station. Only configurable when Periodic Registration is enabled. Values range from 0 to 511 for IS-136 and from 0 to 4095 for IS-54B. A value of 0 disables Periodic Registration.
Default value: 15

- Home registration. Indicates if a home mobile station may register.
Default value: Enabled
- Roam registration. Indicates if a roaming mobile station may register.
Default value: Enabled
- Powerup registration. Indicates if a mobile should register on power up.
Default value: Enabled
- Powerdown registration. Indicates if a mobile should register on power down.
Default value: Enabled
- Location area registration. Indicates if a mobile should register upon entering a new location area.
Default value: Enabled
- System registration For the IS-136 protocol only, register upon entering a new SID area.
Default value: Enabled
- Deregistration For IS-136 only, deregister on reselection to a new network type.
Default value: Disabled
- Forced registration. For IS-136 only, forced registration.
Default value: Enabled

You can click Apply to save the Registration attribute values.

6 Enter the Portable Access attribute values for the cell.

Figure 107 illustrates the Portable Access page on the Cell property sheet for the IS-136 protocol.

Figure 107
IS-136 Cell property sheet, Portable Access page

The screenshot shows a Windows-style dialog box titled "Cell 1 Properties" with a close button (X) in the top right corner. The dialog has four tabs: "Configuration", "Color Codes", "Power", and "Registration". The "Configuration" tab is selected, and within it, the "Portable Access" sub-tab is active. Below the sub-tab, there are four labeled spin controls: "SCAN_INTERVAL:" with a value of 15, "SS_SUFF:" with a value of 29, "RSS_ACC_MIN:" with a value of 0, and "SERV_SS:" with a value of 0. At the bottom of the dialog are four buttons: "OK", "Cancel", "Apply", and "Help".

SCAN_INTERVAL Tells the portable how often to scan for the strongest forward digital control channel. The scan interval can be from 0 to 15 minutes (0-15).
Default value: 15

SS_SUFF	The minimum signal strength, from 0 to 31, sufficient for a control channel to be considered for control-channel reselection. Default value: 29 See ““RSS_ACC_MIN, SS_SUFF, MS_ACC_PWR and RELSEL_OFFSET Parameters” on page 391” for the corresponding signal levels in dBm.
RSS_ACC_MIN	The minimum acceptable received signal strength, from 0 to 31, that a portable requires before it can gain access to this cell. Default value: 0 See ““RSS_ACC_MIN, SS_SUFF, MS_ACC_PWR and RELSEL_OFFSET Parameters” on page 391” for the corresponding signal levels in dBm.
SERV_SS	A nonnegative offset used to favor the preferred neighbor cells, from 0 to 31. Default value: 0

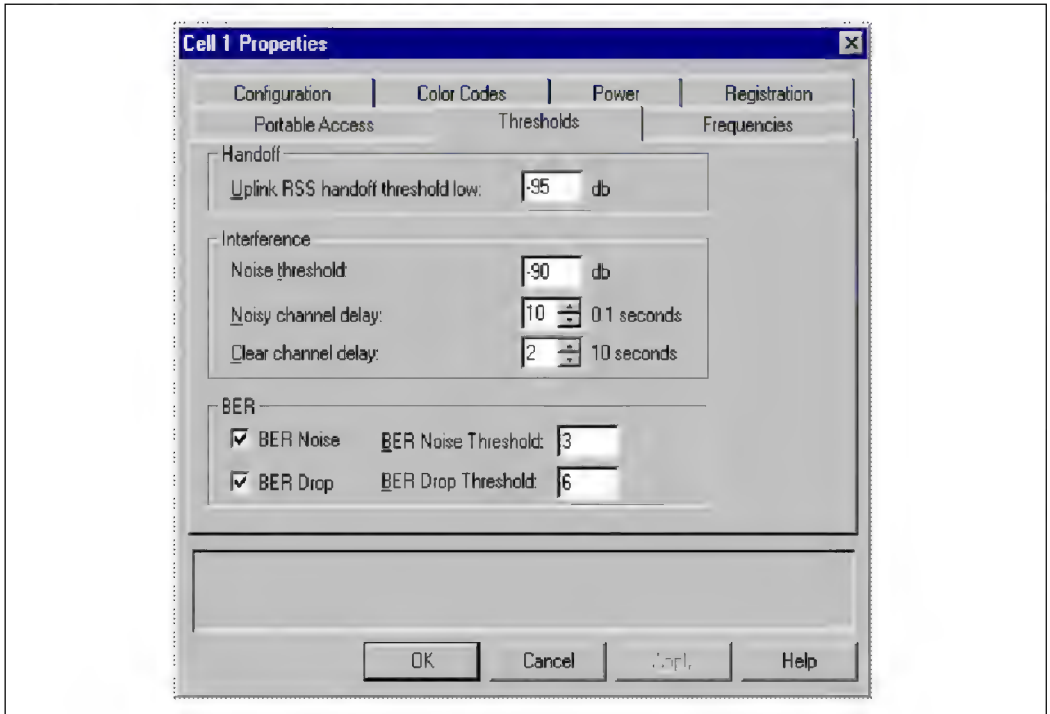
You can click Apply to save the Portable Access attribute values.

7 Enter the Threshold attribute values for the cell.

Figure 108 illustrates the Threshold page on the Cell property sheet for the IS-136 protocol.

Uplink RSS handoff threshold low	The RSSI Handoff Threshold Low (HOTL), from -127 to -30, determines when to hand off a call due to a low RSSI value on the reverse traffic channel (detected by an MBS transceiver). Default value: -95
Noise threshold	Floor value in db that idle traffic radios are to use in determining whether or not they are detecting interference. Threshold values range from -127 to -30. Default value: -90

Figure 108
IS-136 Cell property sheet, Thresholds page



Noisy channel delay The time, in tenths of a second (0.1 second) increments, that an idle traffic radio must detect mobile transmission above the Noise Threshold on the same traffic channel before it can report the channel as noisy. Values range from 0 to 31. Default value: 10

Clear channel delay The time, in ten second increments, that an idle traffic radio must detect mobile transmission below the Noise Threshold on the same traffic channel, before it can report that a previously detected noisy channel is now clear. Values range from 0 to 255. Default value: 2

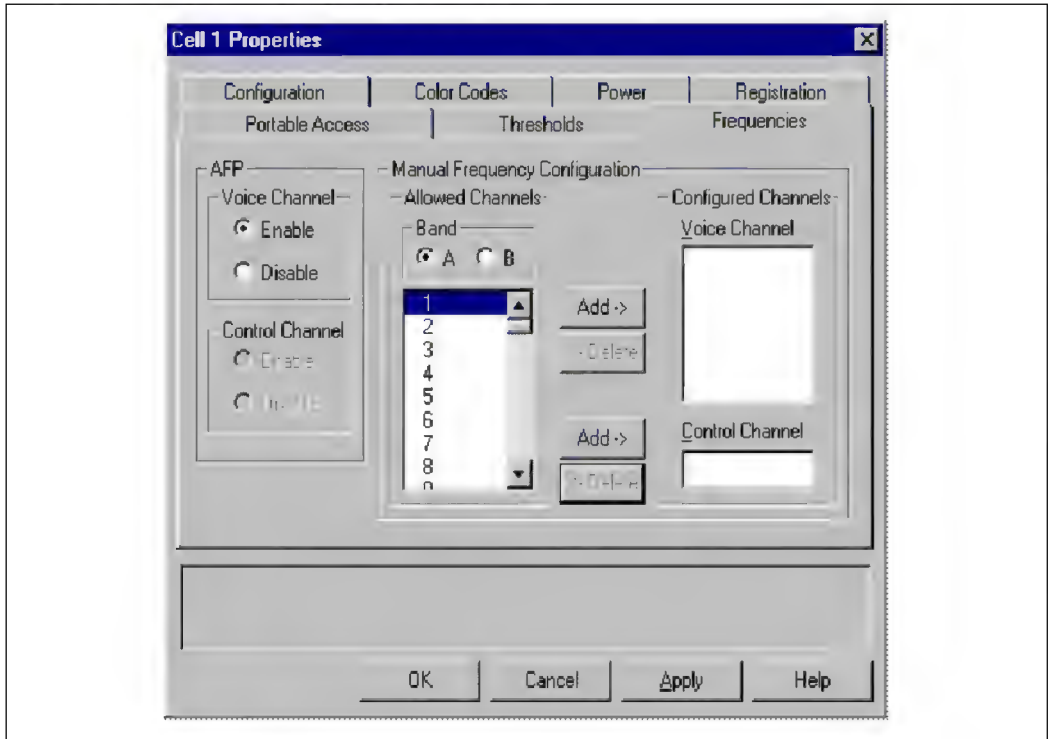
BER Noise	Indicates whether abnormal BER rates should trigger a “normal” interference handoff. Values include enabled and disabled. Default value: Enabled
BER Noise Threshold	The BER noise floor value that is used to determine whether or not system is detecting interference, in which case a “normal” interference handoff will be requested. Threshold values range from 0 to 7. Default value: 3 Each of the values corresponds to a certain percentage range as follows: 0 - less than 0.01% 1 - 0.01% to less than 0.1% 2 - 0.1% to less than 0.5% 3 - 0.5% to less than 1.0% 4 - 1.0% to less than 2.0% 5 - 2.0% to less than 4.0% 6 - 4.0% to less than 8.0% 7 - 8.0% or more
BER Drop	Indicates whether abnormal BER rates should trigger a “high priority” interference handoff. Values include enabled and disabled. Default value: Enabled
BER Drop Threshold	The BER floor value that is used to determine whether or not system is detecting interference, in which case a “high priority” interference handoff will be requested. Threshold values range from 0 to 7. Refer to the mapping used by BER Noise Threshold for corresponding percentage range. Default value: 6

You can click Apply to save the Threshold attribute values.

8 Enter the Frequency attribute values for the cell.

Figure 109 illustrates the Frequencies page on the Cell property sheet for the IS-136 protocol.

Figure 109
IS-136 Cell property sheet, Frequencies page



AFP for voice channel Specifies whether traffic channel is to be configured by AFP.
 Default value: Enabled

AFP for control channel Specifies whether control channel is to be configured by AFP.
 Default value: Enabled

Allowed channels All channels allowable for configuration by the Cellular Operator. Band A values include 1-333, 667-716, and 991-1023. Band B values include 334-666 and 717-799.

Voice channel Channels available for digital voice use, including all the allowed channels. The control channel uses one of these channels if no Control channel value is configured.

Control channel Channel available for the control channel to use.

You can click Apply to save the Frequencies attribute values.

- 9** Click OK to enter the cell attribute values and return to the Cell Object Manager window.

The object manager list box displays information about all the cells in the Microcellular system, including the attribute values. If you need to change an attribute value for a cell, you can highlight the cell in the list box and choose Properties from the File menu to open the property sheet again. Button 2 on your mouse also opens the property sheet.

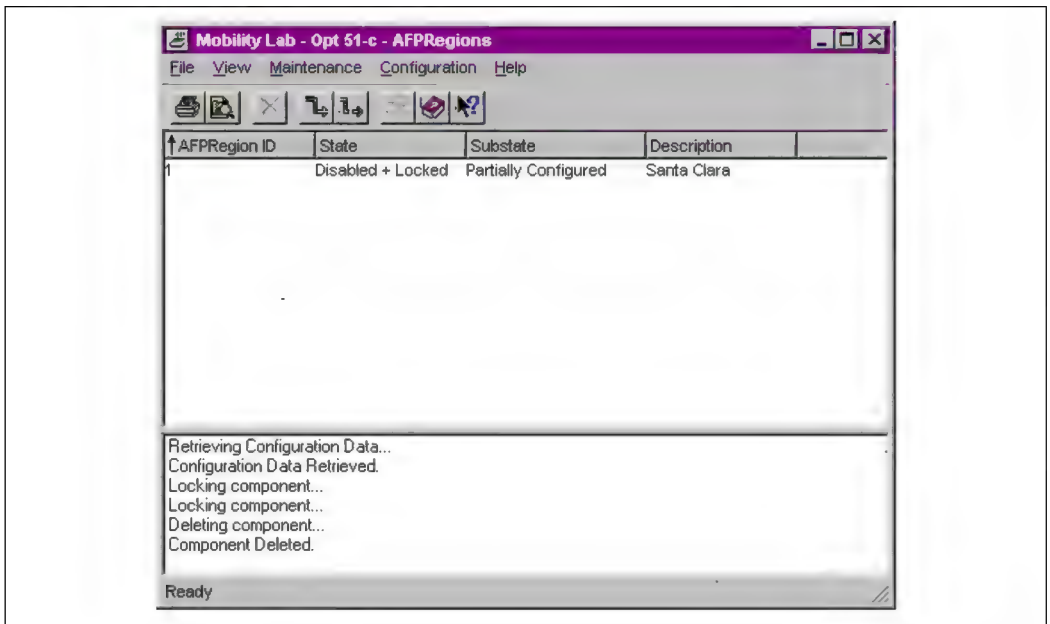
Configuring AFP Region

The AFP Region provides an interface to configure AFP attributes and prohibited channels.

To configure an AFP Region object, perform the following procedure:

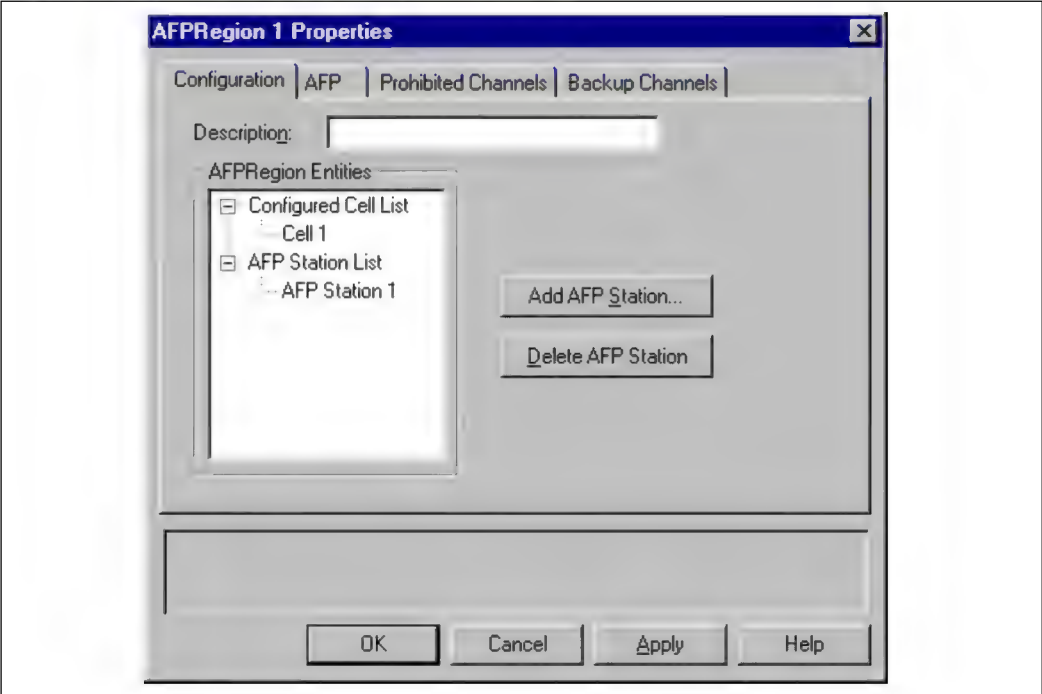
- 1 In the System window, double-click the AFPRegion icon to open the AFP Region Object Manager window, which Figure 110 illustrates.

Figure 110
AFP Region Object Manager window



- 2 Choose Properties from the File menu to open the property sheet of the AFP Region object, which Figure 111 illustrates.

Figure 111
AFP Region property sheet, Configuration page



3 Configure the following AFP Region attribute value:

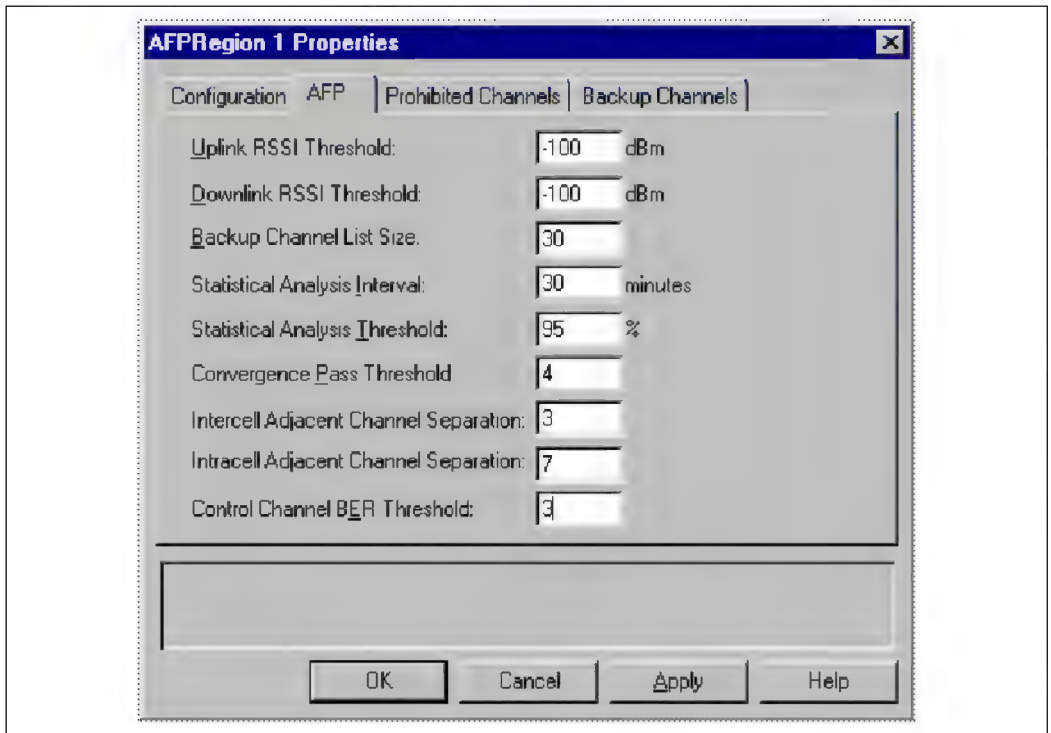
Description	Any alphanumeric characters, up to 30 characters long.
-------------	--

AFPRegion Entities shows configured cells (cells with AFP enabled for either traffic channel and/or control channel) and AFP Stations. Double clicking a selected entity (configured cell or AFP Station) opens the corresponding property sheet.

4 Enter the AFP attribute values for the region.

Figure 112 illustrates the AFP page on the AFP Region property sheet.

Figure 112
AFP Region property sheet, AFP page



Uplink RSSI Threshold Any channel which has an uplink RSSI level above this threshold would not be considered as a control channel nor voice channel. Threshold values range from -127 to -51.
Default value: -100

Downlink RSSI Threshold Any channel which has a downlink RSSI level above this threshold would not be considered as a control channel nor voice channel. Threshold values range from -127 to -51.
Default value: -100

Backup Channel List SizeNumber of backup voice channels. List size ranges from 1 to 416.
Default value: 30

Statistical Analysis IntervalUsed to specify how frequently statistical analysis on the collected RSSI data is performed. Interval values range from 1 to 60 minutes.
Default value: 30

Statistical Analysis ThresholdDuring each statistical analysis, only the percentage of the RSSI values specified by this threshold will be used in the analysis, eliminating high and low values. Threshold values range from 1 to 100.
Default value: 95

Convergence Pass ThresholdConvergence is reached when the backup channel list has not changed for the number of consecutive passes specified by this threshold. Threshold values range from 1 to 10.
Default value: 4

Intercell Adjacent Channel SeparationDetermines the minimum separation between two channels in use in two cells to avoid adjacent-channel interference. Channel separation values range from 0 to 1024.
Default value: 3

Intracell Adjacent Channel Separation Determines the minimum separation between two channels in use within a cell to avoid adjacent-channel interference. Channel separation values range from 0 to 1024.
Default value: 7

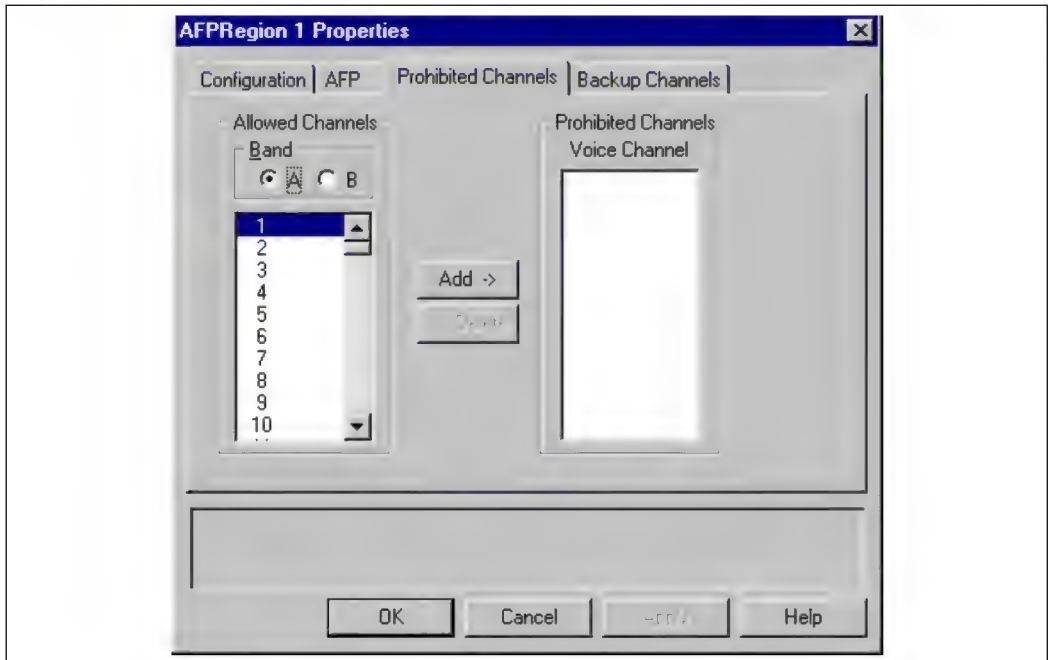
Control Channel BER Threshold An alarm will generate if the measured BER of any control channel exceeds this threshold. Threshold values range from 0 to 7.
Default value: 3

You can click Apply to save the AFP attribute values.

- 7 Enter the Prohibited Channels for the AFP region.

Figure 113 illustrates the Prohibited Channels for the AFP region.

Figure 113
AFP Region property sheet, Prohibited Channels page



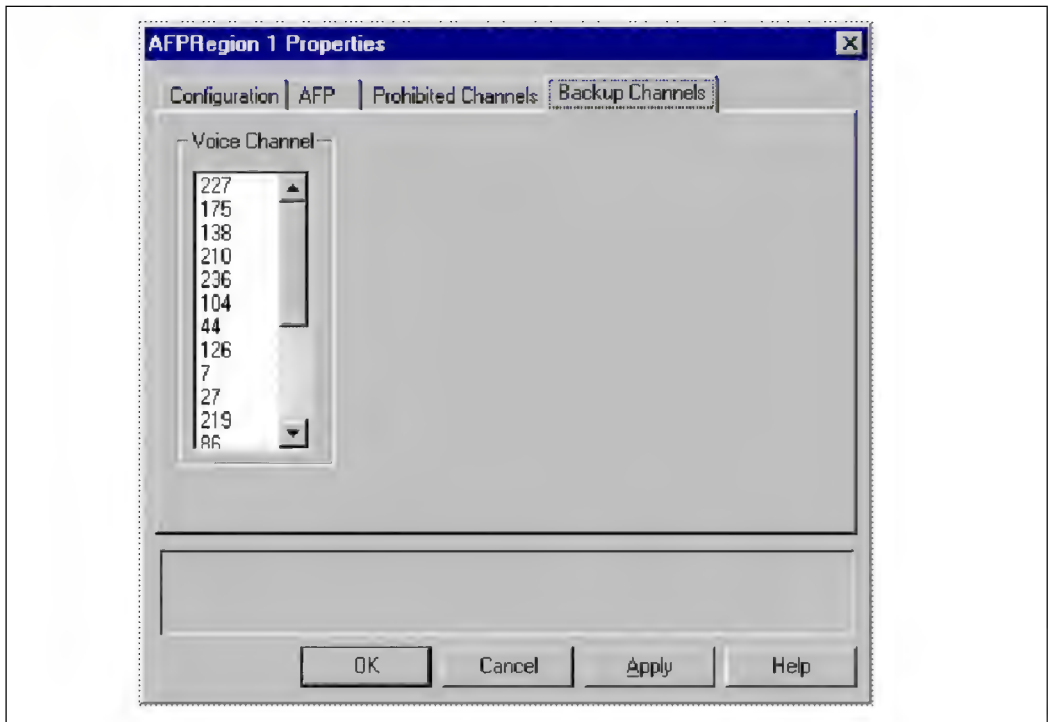
Allowed Channels Channels which AFP searches to find the best voice channels. These channels are owned by the public Cellco. Band A values include 1-333, 667-716 and 991-1023. Band B values include 334-666 and 717-799.

Prohibited Channels Channels that are to be excluded when AFP tries to find the best voice channels. Voice channels are selected from Allowable Channels.

8 View the Backup Channels for the AFP region. (Optional)

Figure 114 illustrates the Backup Channels page on the AFP Region property sheet.

Figure 114
AFP Region property sheet, Backup Channels page

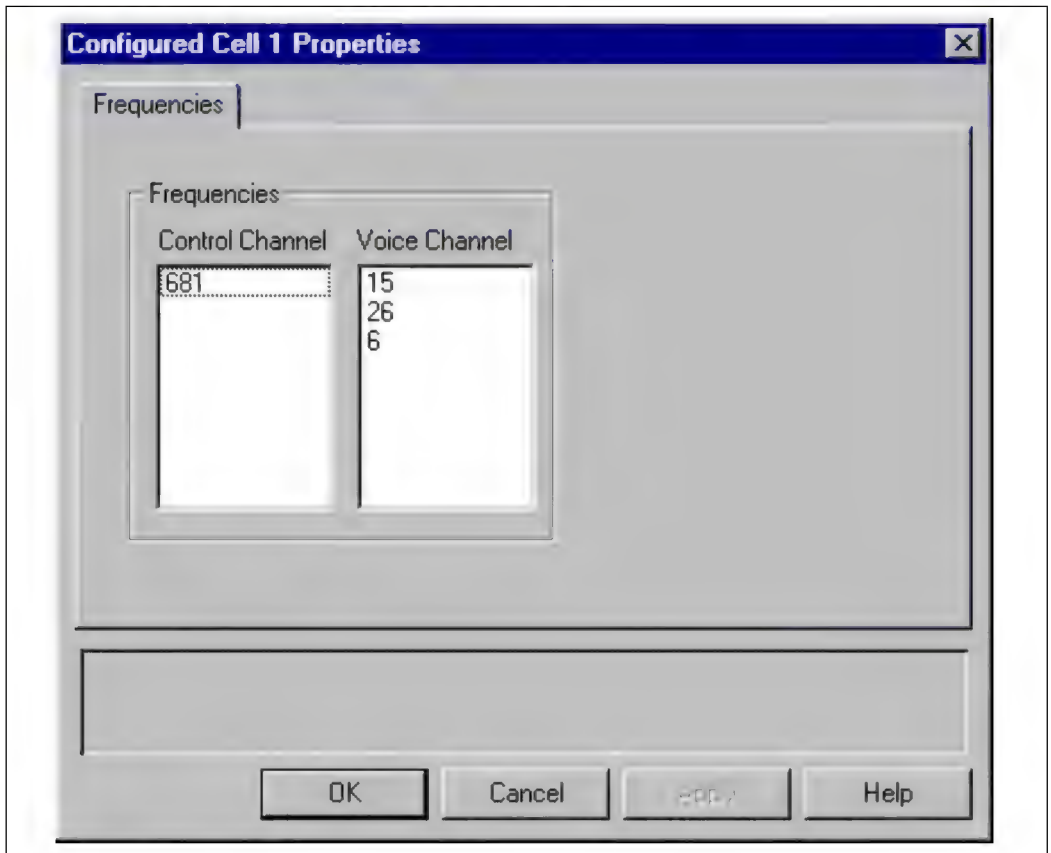


Voice Channel List of voice channels AFP generates. They are in prioritized order in which the top channel is the most favorable. Channels are automatically selected from the Allowable Channels list.

- 6 Click on a cell on the AFP Region property sheet to view the frequencies assigned to the cell. (Optional)

Figure 115 illustrates the Frequencies page on the Configured Cell property sheet.

Figure 115
Configured Cell property sheet, Frequencies page



- Voice Channel

Shows configured (or in use) voice channels. Channels are manually or automatically selected from the Allowed Channels list.
- Control Channel

Shows configured (or in use) control channels. Channels are manually or automatically selected from the Allowed Channels list.

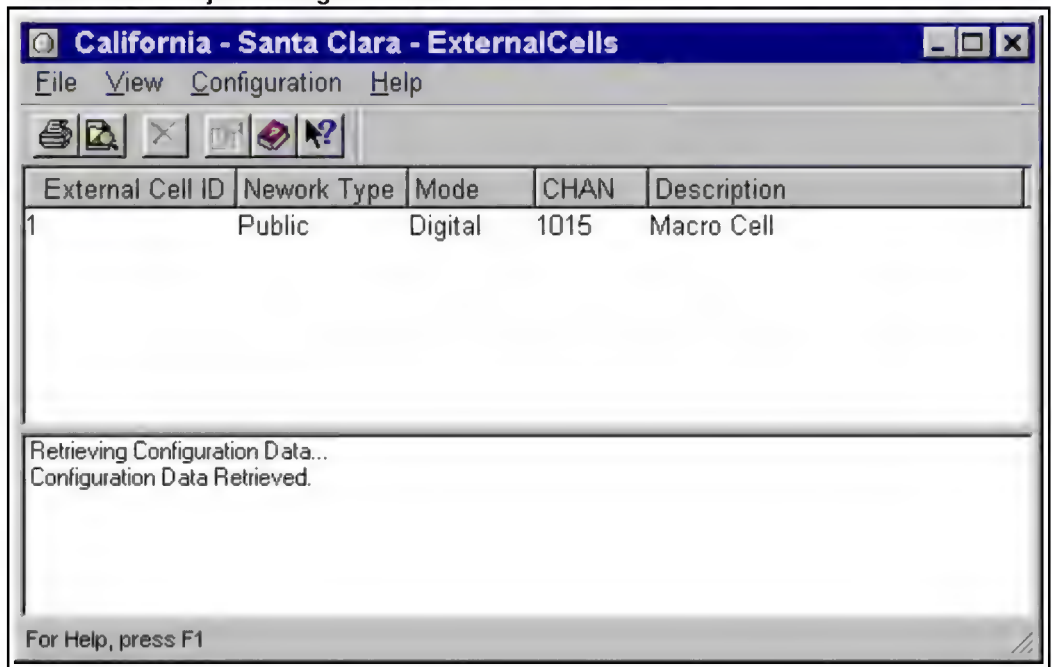
Configuring external cells

External cells are used for control channel reselection purposes. They can be configured automatically by AFP or manually.

To manually add and configure an external cell object, perform the following procedure:

- 1 In the System window, double-click the External Cells icon to open the External Cell Object Manager window, which Figure 116 illustrates.

Figure 116
External Cells Object Manager window



- 2 Choose Add External Cell from the Configuration menu. The object manager adds an external cell object and opens the External Cell property sheet, which Figure 117 illustrates.

Figure 117
External Cell property sheet, Configuration page

External Cell 1 Properties

Configuration

Description:Macro System

Network Type:Public

Mode:Digital

CHAN:1015

MS_ACC_PWR:10

DVCC:99

SS_SUFF:29

DCC:-

BSS_ACC_MIN:0

OK

Cancel

Apply

Help

3 Configure the following external cell attribute values:

Description	Any alphanumeric characters, up to 30 characters long. Example: Macro System
Network type	Network type supported on the control channel. Value is Public, Private, or Residential. Default value: Public
Mode	Whether external system has an analog or digital control channel. Default value: Digital
CHAN	Channel number used by the control channel. Digital values for Band A include 1-333, 667-716, and 991-1023. Digital values for Band B include 334-666 and 717-799. Analog values include 313-333 for System A and 334-354 for System B.
DVCC	Digital Verification Color Code, enabled only if Mode = Digital. Values range from 1 to 255. Default value: 99
DCC	Digital Color Code, enabled only if Mode = Analog. The 8 bits of the specified value include the following bits: SDCC2 = bits 1-4, SDCC1 = bits 5-6, and DCC = bits 7-8. Values range from 0 to 255. Default value: 0
MS_ACC_PWR	Maximum nominal output power that a mobile station shall use when accessing the reverse digital control channel. Values range from 0 to 10. Default value: 10 See ““RSS_ACC_MIN, SS_SUFF, MS_ACC_PWR and RELSEL_OFFSET Parameters” on page 391” for the corresponding signal levels in dBm.
SS_SUFF	Minimum signal strength considered sufficient for a control channel to be considered for control-channel reselection. Values range from 0 to 31. Default value: 29 See ““RSS_ACC_MIN, SS_SUFF, MS_ACC_PWR and RELSEL_OFFSET Parameters” on page 391” for

the corresponding signal levels in dBm.

RSS_ACC_MIN Minimum acceptable control-channel received signal strength for a mobile station to access this cell. Values range from 0 to 31.

Default value: 0

See ““RSS_ACC_MIN, SS_SUFF, MS_ACC_PWR and RELSEL_OFFSET Parameters” on page 391” for the corresponding signal levels in dBm.

- 4 Click OK to save the external cell attribute values and return to the External Cell Object Manager window. The object manager adds an external cell object.

The object manager list box displays information about all the external cells in the Microcellular system. If you need to change any external cell configuration, you can highlight the external cell in the list box and choose External Cells from the Configuration menu to open the External Cells Object Manager window again.

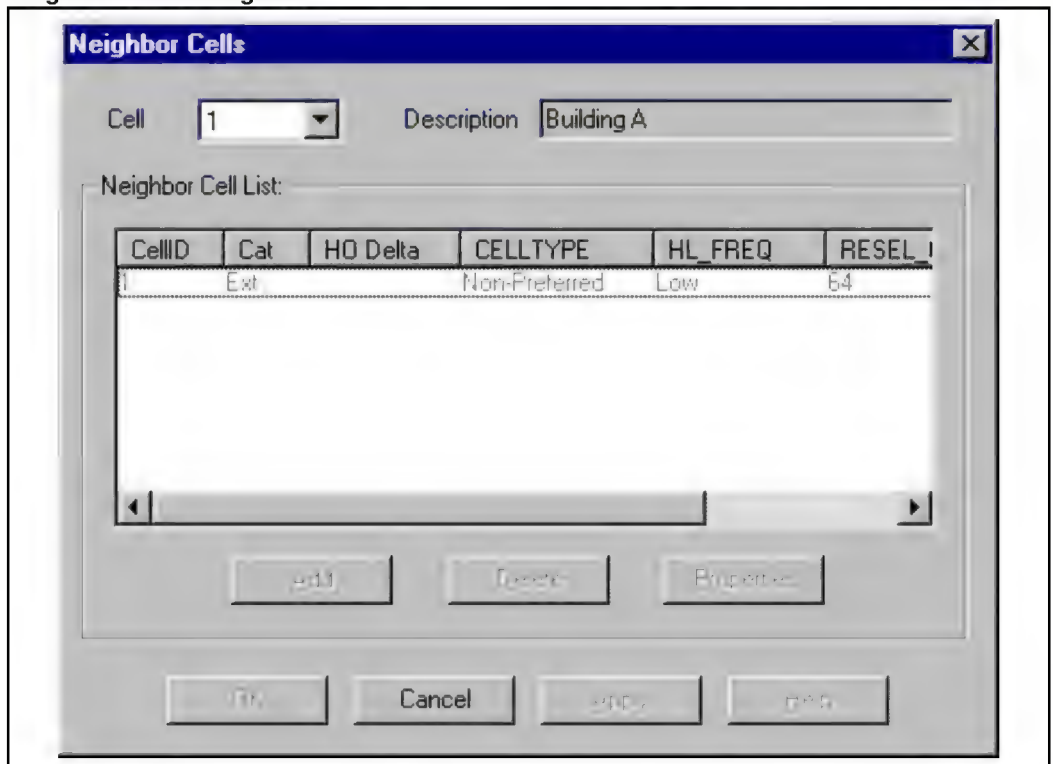
Configuring neighbor cells

You need to configure neighbor cells for control channel reselection. You can configure neighbor cells for any internal cell.

To configure neighbor cells for a cell, perform the following procedure:

- 1 In the Cell Object Manager window, choose Neighbor Cells from the Configuration menu. The object manager opens the Neighbor Cells dialog box, which Figure 118 illustrates.

Figure 118
Neighbor Cells dialog box



2 Define one or more neighbor cells:

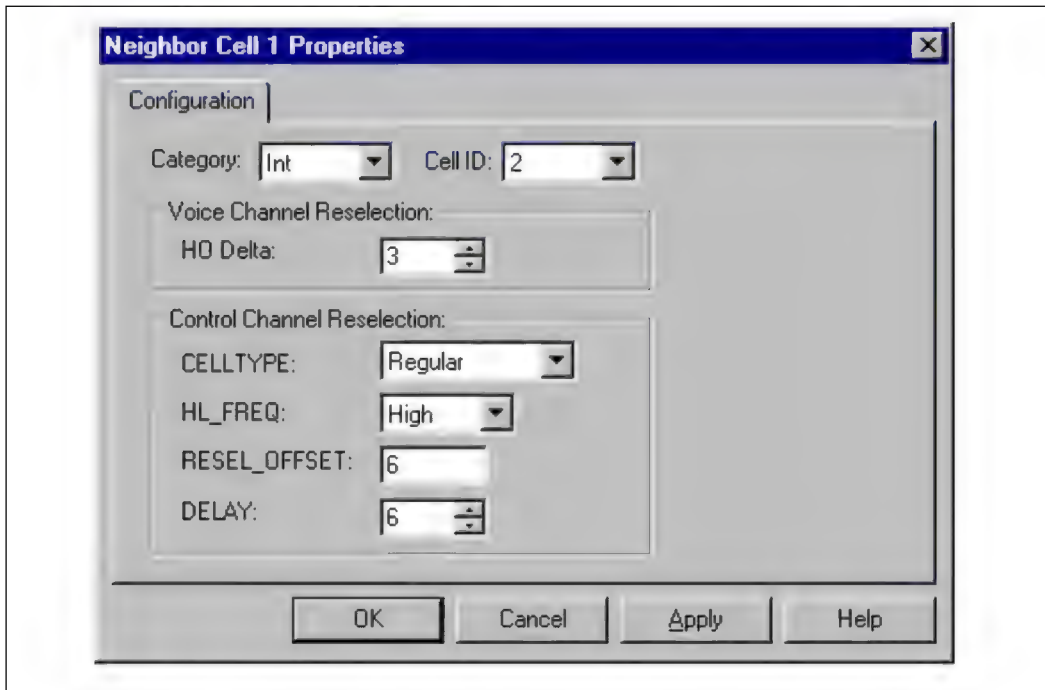
Cell ID The cell number of the cell for which you are configuring a neighbor cell.

Neighbor Cell List lists all currently configured neighbors for the cell.

You can use the Add and Delete buttons to add and delete neighbor cells.

To configure the properties of a neighbor cell, highlight the cell in the Neighbor Cell List and click the Properties button. This opens the Neighbor Cell property sheet, which Figure 119 illustrates.

Figure 119
Neighbor Cell property sheet



3 Configure or select the following neighbor cell attribute values:

Category	Whether the neighbor is an internal or external cell. Default value: Int
Cell ID	List of all internal or external cells that are currently configured for the system.
HO Delta	The difference in dB between the current and target voice channels before a handoff will occur. Disabled when selected neighbor cell is external. Values range from 0 dB to 15 dB. Default value: 3
CELLTYPE	The preference level for cell reselection. A preferred cell has the highest preference, a regular cell the second-highest preference, and a non-preferred cell the lowest preference. Default value for internal neighbor: regular Default value for external neighbor: nonpreferred
HI_FREQ	Used to determine the periodicity of neighbor-channel measurements. Default value for internal cell: low Default value for external cell: high
RESEL_OFFSET	Used to increase or decrease, in 2 dB increments, the preference of a candidate neighbor cell being considered for control-channel reselection. Values range from -128 dB to 126 dB. Default value: 0 See ““RSS_ACC_MIN, SS_SUFF, MS_ACC_PWR and RELSEL_OFFSET Parameters” on page 391” for the corresponding signal levels in dB.
DELAY	Length of time for which a candidate control channel must meet the required signal-strength condition in the control-channel reselection process. DELAY is used to avoid the ping-pong effect at cell boundaries. Values range from 0 to 15, where 0 maps to 0 second, 1 to 13.5 seconds, 2 to 27.0 seconds, and so on. Each increment is 13.5 seconds. Default value: 0

- 4 Click OK to save the neighbor cell attribute values and return to the Neighbor Cell dialog box.

The Neighbor Cell List box displays information about the neighbor cells for the selected cell, including the attribute values. If you need to change an attribute value for a neighbor cell, you can highlight the neighbor cell in the list box and choose Properties from the File menu to open the property sheet again. Button 2 on your mouse also opens the property sheet.

Unlocking the Microcellular subsystem

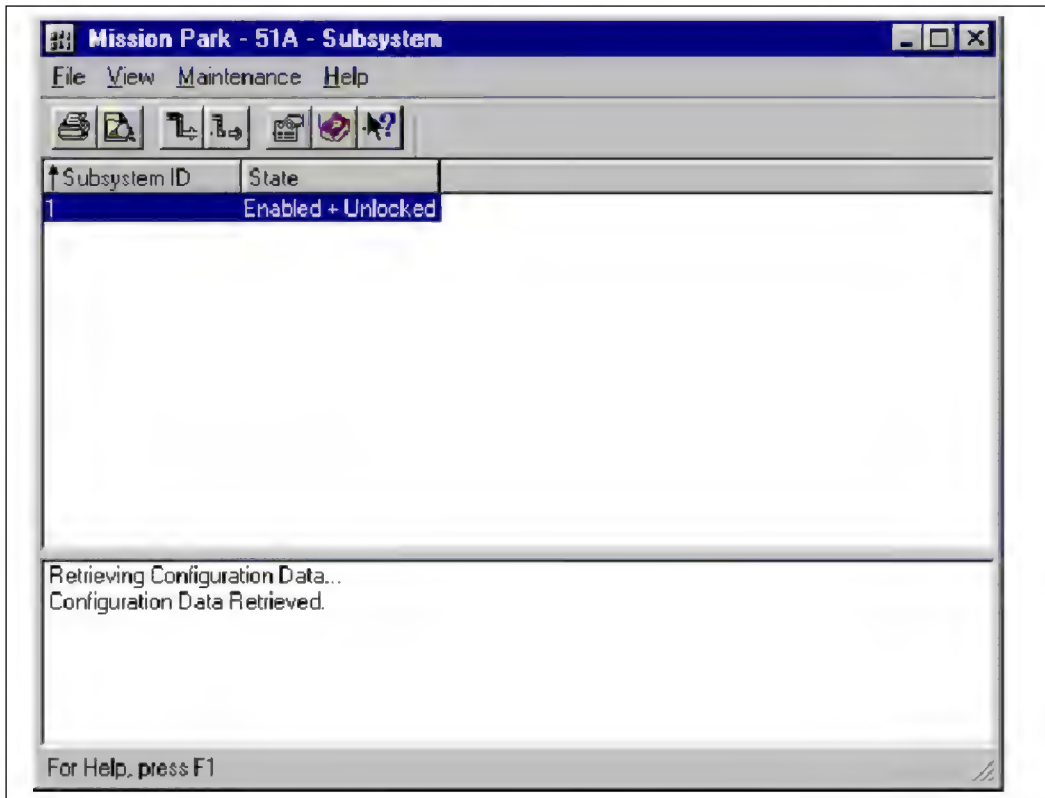
At system start-up, the Microcellular system, which is a subsystem of a Meridian 1 system, is placed in the unlock mode. Thus, unlocking the Microcellular subsystem is not needed at start-up.

If the subsystem is locked, such as locked by the Heartbeat application, you need to unlock the subsystem to enable operation of a Microcellular system.

To unlock the Microcellular subsystem, perform the following procedure:

- 1 In the System window, double-click the Subsystem icon to open the Subsystem Object Manager window, which Figure 120 illustrates.

Figure 120
Subsystem Object window



- 2 Highlight a subsystem in the object list and choose Unlock from the Maintenance menu.

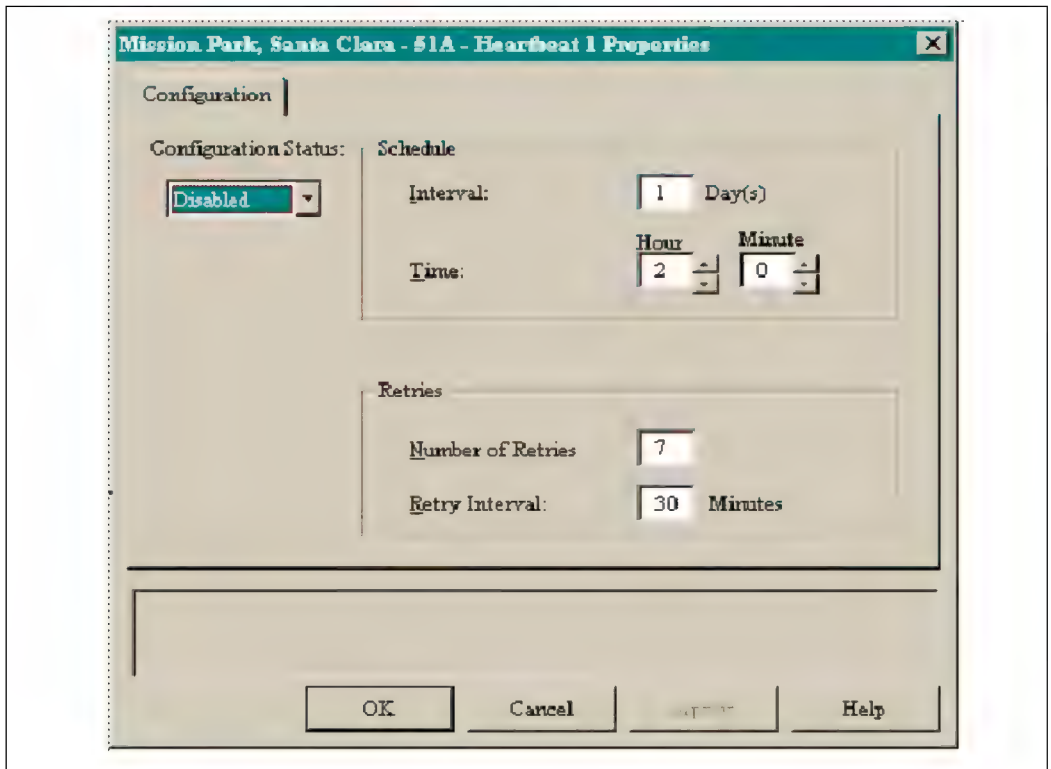
The CMCP unlocks the Microcellular subsystem for the selected Meridian 1 system.

Configuring heartbeat parameters

To configure the heartbeat for a Microcellular system, perform the following procedure:

- 1 In the Heartbeat application window, highlight a Microcellular system in the system list and choose Properties from the File menu. This opens the Heartbeat property sheet, which Figure 121 illustrates.

Figure 121
Heartbeat property sheet



Enter the following Heartbeat attribute values in the Heartbeat property sheet Configuration page:

- | | |
|----------------------|---|
| Configuration Status | Whether the heartbeat is enabled or disabled for the Microcellular system. Choose Enabled and then click Apply. This enables the heartbeat and makes the other Heartbeat attributes available for modification. |
| Interval | The number of days between heartbeat messages. For example, to have the CMCP send a heartbeat every other day, set INTERVAL to 2. Interval ranges from 1 to 3 days.
Default: 1 |
| Time | The time of day at which to send the heartbeat message. For example, to have the CMCP send the heartbeat at 2 p.m., set TIME to 14 hours and 0 minutes.
Default: Hour - 2, Minute - 0 |
| Number of Retries | The number of times the CMCP attempts to resend the heartbeat before all attempts cease. The number of retries value ranges from 0 to 10.
Default value: 7 |
| Retry Interval | The number of minutes between retries to send the heartbeat.
Default value: 30 |

- 2 Click OK or Apply to save the Heartbeat attribute values and return to the Heartbeat window.

The list box in the Heartbeat window displays information about the Microcellular systems that have been added to the CMCP. If you need to change the Heartbeat configuration for a Microcellular system, double-click the system in the list box.

After you configure these parameters the Heartbeat application sends heartbeat messages to the Microcellular system with the help of the Scheduler.

Sending a heartbeat immediately

To ensure that the base communication parameters are configured correctly, send the first heartbeat immediately from the CMCP to the Microcellular system. To send a heartbeat immediately to the Microcellular system, perform the following procedure:

- 1** In the Heartbeat application window, highlight the Microcellular Meridian 1 system in the system list.
- 2** Choose Immediate Heartbeat from the Maintenance menu.

If the immediate heartbeat fails, the CMCP does not automatically perform a retry. A retry requires manual intervention.

Performing Microcellular maintenance

Microcellular maintenance from the CMCP entails ensuring smooth operation of the Microcellular system without interfering with the macrocellular system. You might need to perform the following maintenance tasks from the CMCP:

- Assist the Microcellular customer with initialization of the Microcellular system.
- Assist the Microcellular customer with configuration problems, if any.
- If something interrupts operation of the Microcellular system, assist the customer in bringing the system back up, unlock the subsystem again, and reestablish the heartbeat.
- If the heartbeat fails, help resolve the problem that caused it to fail and then reestablish the heartbeat as soon as possible. (See “Heartbeat Status” .)
- If the Heartbeat or Scheduler application stops running, restart it as soon as possible. The Heartbeat application depends on the scheduler. The CMCP will shut down and lock any Microcellular system for which a heartbeat is configured after three missed heartbeats.
- If the CMCP cannot connect to the Microcellular system to send the heartbeat, reestablish the connection (see the *Meridian Administration Tools Common Services User guide* (A0658266)).

- If the Microcellular system interferes with the macrocellular system, you need to notify the Distributor and the customer and shut the Microcellular system down by using the Subsystem Object manager to lock it.
- If any of the configuration parameters for the Microcellular system change, use the object managers or other windows to reenter the parameters and update the Microcellular system.
- Print reports from the Heartbeat application window and the Microcellular Object Manager windows as needed.

Monitor alarms and operational measurements

Alarms provide information about hardware and resource allocation problems. Operational Measurements (OMs) provide information that you can use to evaluate the performance of a system. The Microcellular system introduces new alarms and OMs. The Cellular Operator can view Microcellular alarms and OMs via a buffer box implementation.

Buffer box implementation

All system alarms and OMs are output to a buffer box located at the customer site. An example of such a buffer box is the Site Event Buffer (SEB) from Teltronics. The buffer box is programmed by the Distributor to deliver a list of alarms and OMs desired or required by the Cellular Operator. The Cellular Operator can view the alarms and OMs via a printer, a monitor or the CMCP as depicted in Figure 122. Delivering alarms and OMs to the CMCP requires a dedicated port.

In addition to delivering the alarm data, pagers can be called for a given alarm.

Microcellular operational measurements

Table 37 lists the Microcellular-specific OMs. This table also provides an example that illustrates a typical report.

Figure 122
Buffer Box Setup

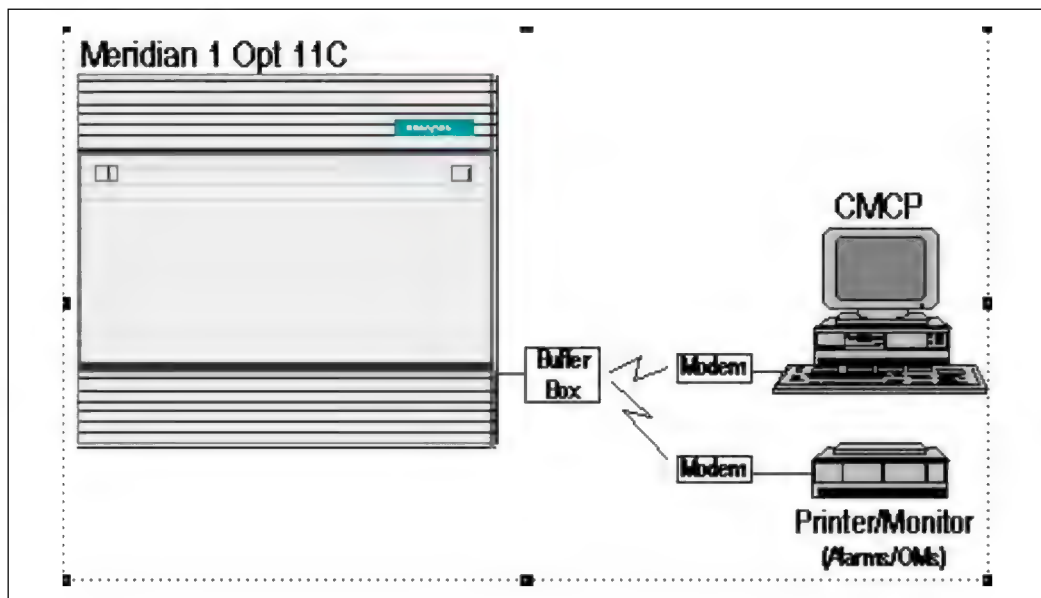


Table 37
Microcellular Operational Measurements

Format						
<System ID>	TFS011					
MISP: <loop #>						
EIMC: <card address> CELL: <cell number>						
	origination attempts	origination completions	termination attempts	termination completions	page attempts	call drops
	handoff attempts	handoff completions	capacity reached			
Example						
0423	TFS011					
MISP: 008						
EIMC: 012 0 11 CELL: 01						
	00005	00005	00002	00002	00010	00000
	00005	00005	00000			

Table 38 describes each of the Microcellular operational measurements.

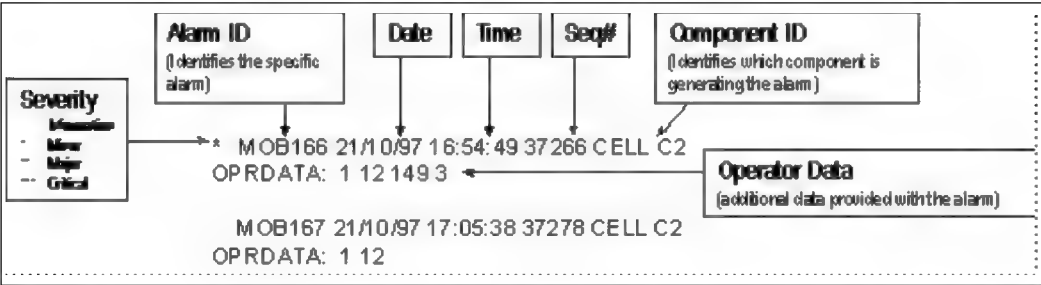
Table 38
Operational Measurement descriptions

Operational Measurement	Description
Origination attempts	Number of originations attempted from a portable on this cell.
Origination completions	Number of originations successfully completed on this cell.
Termination attempts	Number of attempts to terminate a call to a portable on this cell.
Termination completions	Number of terminations successfully completed on this cell.
Page attempts	Number of page messages sent from this cell.
Call drops	Number of active calls dropped on this cell.
Handoff attempts	Number of handoffs attempted from this cell to an adjacent cell.
Handoff completions	Number of handoffs successfully completed.
Capacity reached	Number of times this cell has reached capacity (i.e., all radios are busy).

Microcellular Alarms

Alarm messages contain a severity code, an alarm identification, a component identification, etc., as illustrated in Figure 123.

Figure 123
Microcellular Alarm Information



Technical Support

The Distributor will provide first level support to the customer's Companion Microcellular system. The Cellular Operator may also be involved if it is a cellular issue.

Nortel's Emergency Technical Assistance Support (ETAS) is available 24 hours per day, seven days a week by calling 1-800-766-3827. The call routes automatically based on menu selections.

RSS_ACC_MIN, SS_SUFF, MS_ACC_PWR and RELSEL_OFFSET Parameters

The three RF parameters, "RSS_ACC_MIN", "SS-SUFF" and "MS_ACC_PWR", apply to the IS-136 protocol only and are set by the Cellular Operator via the CMCP. The following tables give the corresponding signal levels in dBm based on the inputs to these three parameters.

Table 39
RSS_ACC_MIN / SS_SUFF Parameter

RSS_ACC_MIN	Signal Level	RSS_ACC_MIN	Signal Level
0	-113 dBm	16	-81 dBm
1	-111 dBm	17	-79 dBm
2	-109 dBm	18	-77 dBm
3	-107 dBm	19	-75 dBm
4	-105 dBm	20	-73 dBm
5	-103 dBm	21	-71 dBm
6	-101 dBm	22	-69 dBm
7	-99 dBm	23	-67 dBm
8	-97 dBm	24	-65 dBm
9	-95 dBm	25	-63 dBm
10	-93 dBm	26	-61 dBm

Table 39
RSS_ACC_MIN / SS_SUFF Parameter

RSS_ACC_MIN	Signal Level	RSS_ACC_MIN	Signal Level
11	-91 dBm	27	-59 dBm
12	-89 dBm	28	-57 dBm
13	-87 dBm	29	-55 dBm
14	-85 dBm	30	-53 dBm
15	-83 dBm	31	-51 dBm

Table 40
MS_ACC_PWR Parameter

MS_ACC_PWR	Signal Level	MS_ACC_PWR	Signal Level
0	36 dBm	6	12 dBm
1	32 dBm	7	8 dBm
2	28 dBm	8	4 dBm
3	24 dBm	9	0 dBm
4	20 dBm	10	-4 dBm
5	16 dBm		

The RESEL_OFFSET parameter applies to the IS-136 protocol only and is set by the Cellular Operator via the CMCP. The following table gives the corresponding signal levels in dB based on the inputs to this parameter.

Table 41
RESEL_OFFSET Parameter

resel_offse t	dB	resel_offse t	dB	resel_offset	dB	resel_offset	dB
0	-128	33	-62	65	2	97	66
1	-126	34	-60	66	4	98	68
2	-124	35	-58	67	6	99	70
3	-122	36	-56	68	8	10	72
4	-120	37	-54	69	10	101	74
5	-118	38	-52	70	12	102	76
6	-116	39	-50	71	14	103	78
7	-114	40	-48	72	16	104	80
8	-112	41	-46	73	18	105	82
9	-110	42	-44	74	20	106	84
10	-108	43	-42	75	22	107	86
11	-106	44	-40	76	24	108	88
12	-104	45	-38	77	26	109	90
13	-102	46	-36	78	38	110	92
14	-100	47	-34	79	30	111	94
15	-98	48	-32	80	32	112	96
16	-96	49	-30	81	34	113	98
17	-94	50	-28	82	36	114	100
18	-92	51	-26	83	38	115	102
19	-90	52	-24	84	40	116	104
20	-88	53	-22	85	42	117	106
21	-86	54	-20	86	44	118	108

Table 41
RESEL_OFFSET Parameter

resel_offse t	dB	resel_offse t	dB	resel_offset	dB	resel_offset	dB
22	-84	55	-18	87	46	119	110
23	-82	56	-16	88	48	120	112
24	-80	57	-14	89	50	121	114
25	-78	58	-12	90	52	122	116
26	-76	59	-10	91	54	123	118
27	-74	60	-8	92	56	124	120
28	-72	61	-6	93	58	125	122
28	-70	62	-4	94	60	126	124
30	-68	63	-2	95	62	127	126
31	-66	64	0	96	64		
32	-64						

The Cellular Operator has control over all configurable RF parameters. Table 42 gives a mapping between standard IS-136 terminology and equivalent names used within Nortel. The table also indicates whether a given parameter is configurable via CMCP and viewable via MSM.

Table 42
Radio Engineering Parameters

DCCH Structure				
			Range of Values	Value if Set
Parameters	Nortel Name	Fixed Value	if Set by CMCP	by MAT
Number of F-BCCH	n/a	4	n/a	n/a
Number of E-BCCH	n/a	2	n/a	n/a
Number of S-BCCH	n/a	0	n/a	n/a
Slot Configuration	n/a	1	n/a	n/a
DVCC	Digital Control Channel DVCC	n/a	1-(99)-255	read only
	Voice Control Channel DVCC	n/a	1-(8)-255	read only
MAX_SUPPORTED_PFC	n/a	0	n/a	n/a
PCH_DISPLACEMENT	n/a	0	n/a	n/a
PFM_DIRECTION*	n/a	0	n/a	n/a
Number of non-PCH Subchannel Slots	n/a	0	n/a	n/a
Access Parameters				
			Range of Values	Value if Set
Parameters	Nortel Name	Fixed Value	if Set by CMCP	by MAT
Auth	n/a	0	n/a	n/a

Table 42
Radio Engineering Parameters

S	n/a	1	n/a	n/a
RAND	n/a	0	n/a	n/a
MS_ACC_PWR	MS_ACC_PWR	n/a	0-(10)	read only
Access Burst Size	n/a	0	n/a	n/a
Max Retries	n/a	4	n/a	n/a
Max Busy/Reserved	n/a	0	n/a	n/a
Max Repetitions	n/a	3	n/a	n/a
Max Stop Counter	n/a	1	n/a	n/a
R-Data Message Length	n/a	0	n/a	n/a
Cell Barred	n/a	0	n/a	n/a
Subaddressing Support	n/a	0	n/a	n/a
Delay Interval Compensation Mode	n/a	1	n/a	n/a
Control Channel Selection Parameters				
			Range of Values	Value if Set
Parameters	Nortel Name	Fixed Value	if Set by CMCP	by MAT
SS_SUFF	SS_SUFF	n/a	0-(29)-31	read only
RSS_ACC_MIN	RSS_ACC_MIN	n/a	(0) - 31	read only
SCANINTERVAL	SCAN_INTERVAL	n/a	0-(15)	read only

Table 42
Radio Engineering Parameters

Initial Selection Control	n/a	Order of Configured Channels	n/a	n/a
DELAY	n/a	0	n/a	n/a
Scanning Option Indicator	n/a	0	n/a	n/a
Registration Parameters				
			Range of Values	Value if Set
Parameters	Nortel Name	Fixed Value	if Set by CMCP	by MAT
REGH	Home Registration	n/a	"(Enabled), Disabled"	read only
REGR	Roam Registration	n/a	"(Enabled), Disabled"	read only
PUREG	Powerup Registration	n/a	"(Enabled), Disabled"	read only
PDREG	Powerdown Registration	n/a	"(Enabled), Disabled"	read only
SYREG	System Registration	n/a	"(Enabled), Disabled"	read only
LAREG	Location Area Registration	n/a	"(Enabled), Disabled"	read only
DEREG	Deregistration	n/a	"Enabled, (Disabled)"	read only
FOREG	Forced Registration	n/a	"(Enabled), Disabled"	read only
Capacity Request	n/a	0	n/a	n/a
Present RNUM	RNUM	n/a	0-1023	read only

Table 42
Radio Engineering Parameters

REG Period	Autonomous Registration Period	n/a	0-(15)-511	read only
System Identity				
			Range of Values	Value if Set
Parameters	Nortel Name	Fixed Value	if Set by CMCP	by MAT
SID	Macro System ID	n/a	0-32767	read only
Network Type	n/a	private	n/a	n/a
Protocol Version	n/a	2	n/a	n/a
PSID/RSID Set	PSID	n/a	1-61439	read only
	System Operator	n/a	"1-2047,2049-4095"	read only
	AlphaPSID	n/a	15 ASCII Characters	read only
Mobile Country Code	n/a	0	n/a	n/a
Alphanumeric System ID	n/a	0	n/a	n/a
Neighbor Cell				
			Range of Values	Value if Set
Parameters	Nortel Name	Fixed Value	if Set by CMCP	by MAT
Serv_SS	SERV_SS	n/a	0-(29)-31	read only
Non-Public Probability Blocks	not supported by MBS	not supported by MBS	not supported by MBS	not supported

Table 42
Radio Engineering Parameters

Neighbor Cell List (TDMA)				
Number of TDMA Neighbor Cells	n/a	max 24	n/a	n/a
Neighbor Cell (one list per neighbor):				
CHAN	CHAN	n/a	Band A or Band B	read only
Protocol Version	n/a	2	n/a	n/a
DVCC	DVCC	n/a	1-(99)-255	read only
RESEL_OFFSET	RESEL_OFFSET	n/a	""-128 dm""-(0)-126 dm"	read only
SS_SUFF	SS_SUFF	n/a	0-(29)-31	read only
DELAY	DELAY	n/a	(0)-15	read only
HL_FREQ	HL_FREQ [for external cell]	n/a	"(Low), High"	read only
	HL_FREQ [for internal cell]	n/a	"Low, (High)"	read only
CELL_SYNC	n/a	0	n/a	n/a
CELLTYPE	CELLTYPE [for external cell]	n/a	"Preferred,Regular,(Non-Preferred)"	read only
	CELLTYPE [for internal cell]	n/a	"Preferred,(Regular),Non-Preferred"	read only
Network Type	NETWORKTYPE [for external cell]	n/a	"(Public), Private, Residential"	read only
Directed Retry Channel	n/a	0	n/a	n/a

Table 42
Radio Engineering Parameters

MS_ACC_PWR	MS_ACC_PWR	n/a	0-(10)	read only
RSS_ACC_MIN	RSS_ACC_MIN	n/a	(0)-31	read only
PSID/RSID Indicator*	n/a	0	n/a	n/a
PSID/RSID Support Length*	n/a	0	n/a	n/a
PSID/RSID Support*	n/a	0	n/a	n/a
Neighbor Cell List (Analog)				
Number of Analog Neighbor Cells	n/a	max 5	n/a	n/a
Analog Neighbor Cell (one list per neighbor)				
CHAN	CHAN	n/a	Band A or Band B	read only
Protocol Version	n/a	2	n/a	n/a
Digital Color Code (DCC)	DCC	n/a	(0)-3	read only
RESEL_OFFSET	RESEL_OFFSET	n/a	""-128 dm"" - (0)-126 dm"	read only
SS_SUFF	SS_SUFF	n/a	0-(29)-31	read only
DELAY	DELAY	n/a	(0)-15	read only
HL_FREQ	HL_FREQ [for external cell]	n/a	"(Low), High"	read only

Table 42
Radio Engineering Parameters

CELLTYPE	CELLTYPE [for external cell]	n/a	"Preferred,Regular,(Non-Preferred)"	read only
	CELLTYPE [for internal cell]	n/a	"Preferred,(Regular),Non-Preferred"	read only
Network Type	NETWORKTYPE [for external cell]	n/a	"(Public), Private, Residential"	read only
Directed Retry Channel	n/a	0	n/a	n/a
MS_ACC_PWR	MS_ACC_PWR	n/a	0-(10)	read only
RSS_ACC_MIN	RSS_ACC_MIN	n/a	(0)-31	read only
Regulatory Configuration				
			Range of Values	Value if Set
Parameters	Nortel Name	Fixed Value	if Set by CMCP	by MAT
RCI	n/a	1	n/a	n/a
RF Channel Allocation	n/a	Order of Configured Channels	n/a	n/a

Table 42
Radio Engineering Parameters

Others				
AlphaPSID:Where is this used? Is it part of Test Registration Response?				
It is used with Test Registration.				
DMAC : [0-10].	VMAC / DMAC	n/a	0-(7)	read only
Legends:				
n/a : not applicable				
() : Default value of the CMCP parameters				

Property sheets for the IS-54B protocol

This section shows all zone and cell property sheets for the IS-54B implementation that are excluded in the “Configuring and maintaining Microcellular systems” section. Since reselection in an IS-54B implementation is based on the strongest signal, there is no need to configure external cells and neighbor cells.

Figure 124 illustrates the Zone property sheet for the IS-54B protocol.

Figure 124
IS-54B Zone property sheet

ZONE 2 Properties

Configuration

EIMC ID: 1

Description: Building A

Macro System ID:

Location ID:

OK Cancel Apply Help

Macro System ID A 15-bit System ID (SID) assigned to each U.S. macrocellular system by the FCC. Each mobile station stores this ID to identify the station's home system.

Example: 31

Location ID A 12-bit number that a portable uses to determine changes in its location area and whether it needs to register. Location ID values range from -1 to 4095. The default value is 0. The value -1 indicates that there is no location ID.

Example: 1

Figure 125 illustrates the Configuration page on the Cell property sheet for the IS-54B protocol.

Figure 125
 IS-54B Cell property sheet, Configuration page

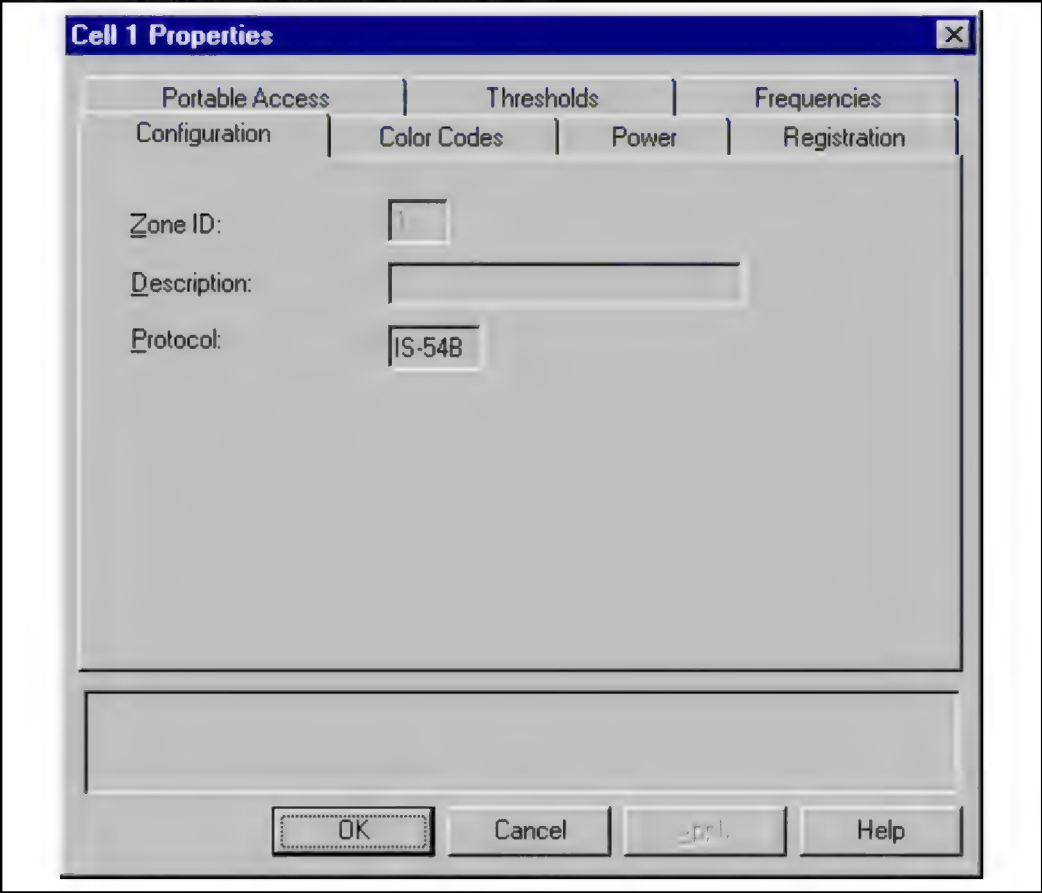
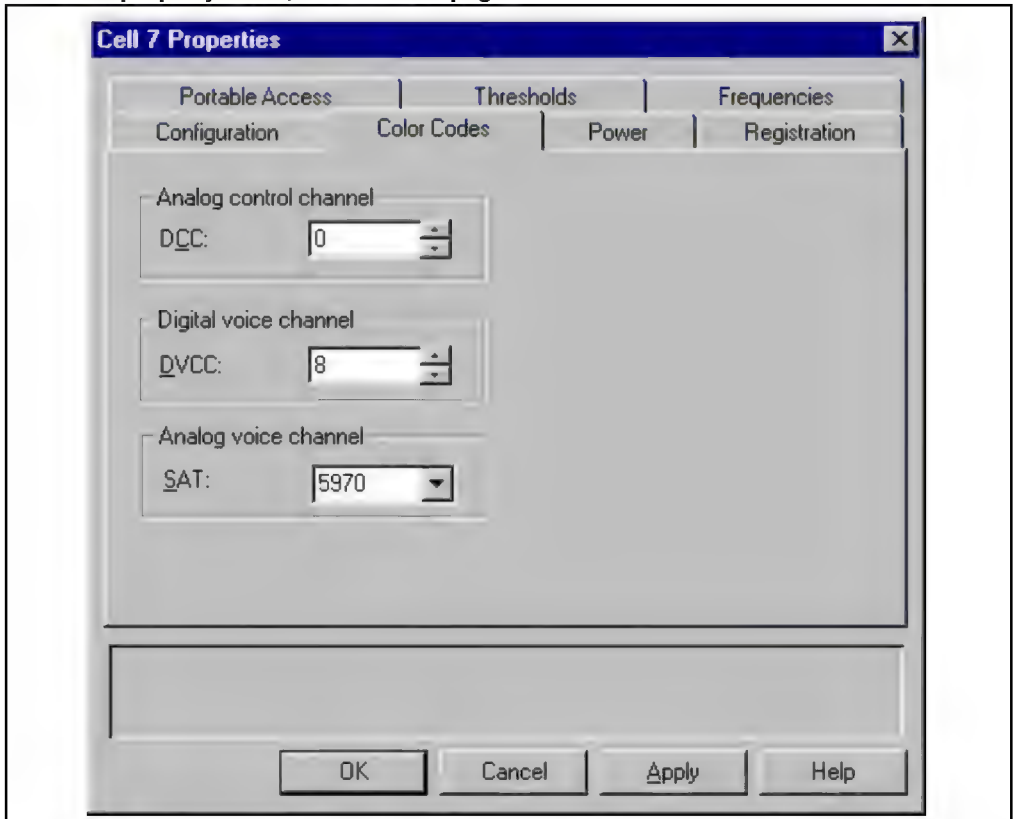


Figure 126 illustrates the Color Codes page on the Cell property sheet for the IS-54B protocol.

Figure 126
IS-54B Cell property sheet, Color Codes page



- DCC** A Digital Color Code (DCC). An MBS transmits this 2-bit signal on a forward control channel that detects capture of an MBS by an interfering mobile station. The Microcellular system generates the DCC value automatically, but you can change it to an integer in the range 0 to 3.
 Default value: 0
- DVCC (voice)** An 8-bit Digital Verification Color Code that the MBS sends to the portable to generate the CDVCC, which is used to distinguish the current traffic from the traffic co-channels. The Microcellular system generates the

	DVCC value automatically, but, but you can change the value to any integer in the range 1 to 255. Default value: 8
SAT	For the IS-54B protocol only, Analog Supervisory Audio Tone (SAT) color code to be added to an analog voice transmission by the base station. A mobile station must detect, filter, and modulate the transmitted voice-channel carrier with this tone. Values include 5970, 6000, and 6030. Default value: 5970

Figure 127 illustrates the Power page on the Cell property sheet for the IS-54B protocol.

Figure 127
IS-54B Cell property sheet, Power page

Cell 1 Properties

Portable Access | Thresholds | Frequencies
 Configuration | Color Codes | **Power** | Registration

☐ Mobile attenuation codes

VMAC/DMAC: 7

MS_ACC_PWR: 7

Lowest mobile attenuation: 7

☐ Radio attenuation

Power Level:

☒ High

☐ Low

☐ Handoff

ERP Delta: 0

ICH Talk in/Talk out: 0

RSSI Sample Rate: 2

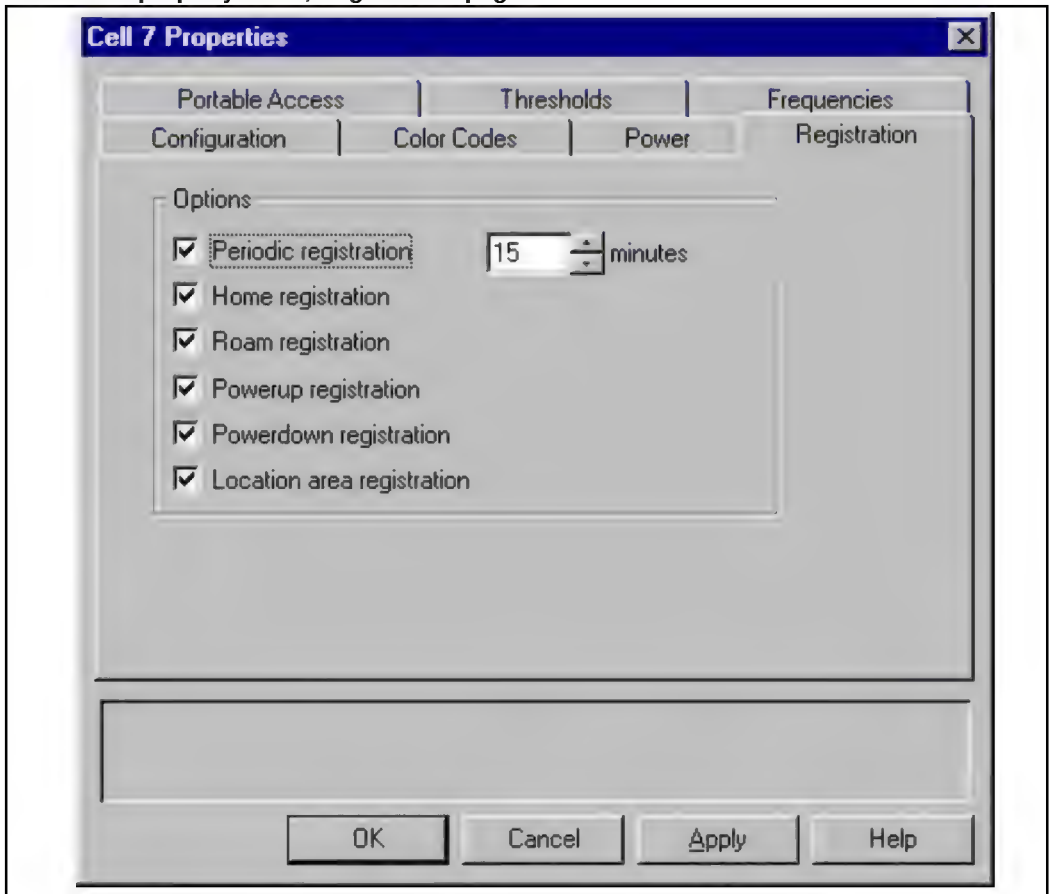
OK Cancel Apply Help

VMAC/DMAC A 4-bit Voice Mobile Attenuation Code/Data Mobile Attenuation Code) that indicates the initial power attenuation level a portable is assigned when given service on a digital voice channel. For backward compatibility, values for 8, 9 and 10 are treated as 7 for IS-54B cells. VMAC/DMAC values range from 0 to 7. Default value: 7

CMAC	A 3-bit Control Mobile Attenuation Code (CMAC) that indicates the mobile station power level associated with the reverse control channel. CMAC values range from 0 to 7. Default value: 7
Lowest allowed module attenuation	Voice Channel Mobile Attenuation Code Minimum. Indicates the lowest attenuation level (maximum power) that a mobile station should transmit while in this cell. Values range from 0 to 7 Default value: 0
ERP Delta	Effective Radiated Power (ERP) Delta. Specifies the difference, in dB, between the ERP of the TCH and the CCH. Values range from 0 to 10. Default value: 0
TCH Talk in/Talk out	Traffic channel Talk In Talk Out Specifies the difference, in db, between the MBS VCH RF receive level of the mobile station and the mobile’s RF receive level of the MBS for a class one mobile operating at the MAHO cell’s vMax. Values range from -15 to 15. Default value: 0
RSSI Sample Rate	The rate of sampling of MAHO measurements done by the DRU. Values range from 0 to 15. Default value: 4
Power level	Radio buttons to select MBS power level. This indicates the attenuation level at which an MBS transceiver should transmit. The TRU-II supports only High (0) and Low (3). Default value: Low

Figure 128 illustrates the Registration page on the Cell property sheet for the IS-54B protocol.

Figure 128
IS-54B Cell property sheet, Registration page



Periodic registration. Indicates if Periodic Registration is active.
Default value: Enabled

Periodic registration period. Minutes between autonomous registrations by a mobile station. Only configurable when Periodic Registration is enabled. Values range from 0 to 511 for IS-136 and from 0 to 4095 for IS-54B. A value of 0 disables Periodic Registration.
Default value: 15

Home registration. Indicates if a home mobile station may register.
Default value: Enabled

Roam registration. Indicates if a roaming mobile station may register.
Default value: Enabled

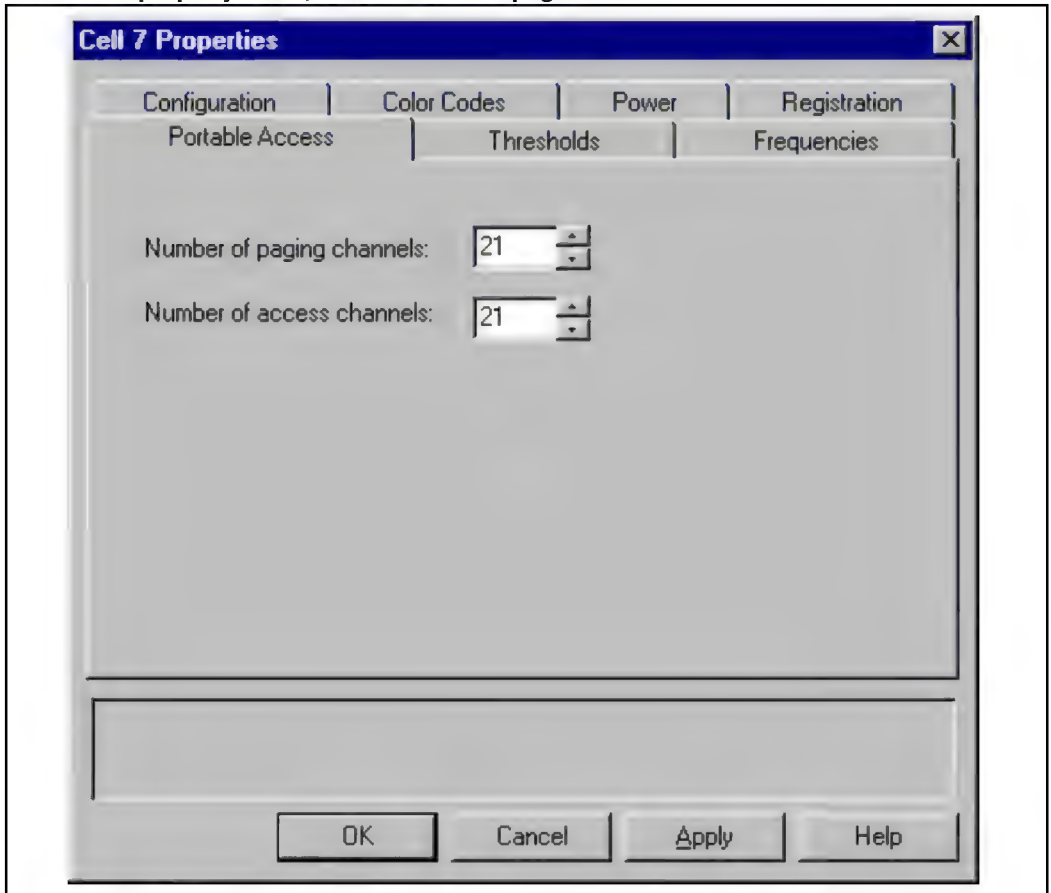
Powerup registration. Indicates if a mobile should register on power up.
Default value: Enabled

Powerdown registration. Indicates if a mobile should register on power down.
Default value: Enabled

Location area registration. Indicates if a mobile should register upon entering a new location area.
Default value: Enabled

Figure 129 illustrates the Portable Access page on the Cell property sheet for the IS-54B protocol.

Figure 129
IS-54B Cell property sheet, Portable Access page



Number of paging channels The number of analog paging channels that mobiles must scan, from 0 to 21 (IS-54's "N" parameter).
Default value: 21

Number of access channels The number of analog access channels that mobiles must scan, from 0 to 21 (IS-54's "CMAX" parameter).
Default value: 21

Figure 130 illustrates the Threshold page on the Cell property sheet for the IS-54B protocol.

Figure 130
 IS-54B Cell property sheet, Thresholds page

Cell 2 Properties

Configuration

Color Codes

Power

Registration

Portable Access

Thresholds

Frequencies

Handoff

Uplink RSS handoff threshold low:

-95

db

Interference

Noise threshold:

-90

db

Noisy channel delay:

10

0.1 seconds

Clear channel delay:

2

10 seconds

BER

☒ BER Noise

BER Noise Threshold:

3

☒ BER Drop

BER Drop Threshold:

6

OK

Cancel

Help

Uplink RSS handoff threshold low The RSSI Handoff Threshold Low (HOTL), from -127 to -30, determines when to hand off a call due to a low RSSI value on the reverse traffic channel (detected by an MBS transceiver).
 Default value: -95

Noise threshold	Floor value in db that idle traffic radios are to use in determining whether or not they are detecting interference. Threshold values range from -127 to -30. Default value: -90
Noisy channel delay	The time, in tenths of a second (0.1 second) increments, that an idle traffic radio must detect mobile transmission above the Noise Threshold on the same traffic channel before it can report the channel as noisy. Values range from 0 to 31. Default value: 10
Clear channel delay	The time, in ten second increments, that an idle traffic radio must detect mobile transmission below the Noise Threshold on the same traffic channel, before it can report that a previously detected noisy channel is now clear. Values range from 0 to 255. Default value: 2
BER Noise	Indicates whether BER on idle traffic channels is to be monitored and reported. Values include enabled and disabled. Default value: Enabled
BER Noise Threshold	The BER noise floor value that idle traffic radios are to use in determining whether or not they are detecting interference. Threshold values range from 0 to 7. Default value: 3
BER Drop	Indicates whether BER on active traffic channels is to be monitored and reported. Values include enabled and disabled. Default value: Enabled

BER Drop Threshold The BER drop floor value that active traffic radios are to use in determining whether or not they are detecting interference in which case interference handoff will be requested. Threshold values range from 0 to 7.
Default value: 6

Figure 131 illustrates the Frequencies page on the Cell property sheet for the IS-54B protocol.

Figure 131
IS-54B Cell property sheet, Frequencies page

Cell 7 Properties

Configuration | Color Codes | Power | Registration | Portable Access | Thresholds | **Frequencies**

Allowed Channels

Band: ☐ G ☐ A ☐ C ☐ B

3
4
5
6
7
8
10
11
12
13
14

Add ->
<- Delete
Add <->
<- Delete

Configured Channels

Voice channel
1
2

Control channel
9

OK Cancel Apply Help

AFP for voice channel Specifies whether traffic channel is to be configured by AFP.
Default value: Enabled

AFP for control channel	Specifies whether control channel is to be configured by AFP. Default value: Enabled
Allowed channels	All channels allowable for configuration by the Cellular Operator. Band A values include 1-333, 667-716, and 991-1023. Band B values include 334-666 and 717-799.
Voice channel	Channels available for digital voice use, including all the allowed channels. The control channel uses one of these channels if no Control channel value is configured.
Control channel	Channel available for the control channel to use.

List of terms

ACELP

Algebraic Code Excited Linear Predictive, a method of implementing EFRC (Enhanced Full Rate Codec) in TDMA systems for improved digital voice quality. TDMA-3 ACELP implements the IS-641 protocol in IS-136 systems. A Microcellular system can support both ACELP and VSELP users. See also *IS-136*, *IS-641*, and *VSELP*.

AFP

See Automatic Frequency Planning.

AFP region

A Microcellular system component that is the parent of one or more AFP Stations.

AFPS

See Automatic Frequency Planning Station.

AMO

Antenna Matrix/Oscillator.

antenna matrix (4 x 4)

The elements internal to the MBS that allow all 4 internal TRU-IIs to be connected to all 4 antenna ports.

antenna structure

The antenna elements, external to the MBS, including the antennas, cables, and hybrids (splitters/combiners).

APS

Alarm and Power Supply Module, part of the MBS assembly.

Automatic Frequency Planning (AFP)

A feature of the Microcellular system that automates the assignment and adjustment of microcell operating frequencies so that they do not interfere with the macrocellular system.

Automatic Frequency Planning Station (AFPS)

A scanner/receiver connected to the Meridian 1 system that measures forward and reverse RSSI on specified channels, extracts information from macrocell channels, and returns the Bit Error Rate on specified Microcellular control channels. The AFPS helps the cellular operator determine what channels are available for the Microcellular system to use.

AWG

American Wiring Gauge.

Base Station

See *Microcellular Base Station*.

CAI

See *Common Air Interface*.

cell

The portion of a zone, or radio coverage area, served by a control-channel radio and from one to 15 traffic radios. A cell is also called a partition. Cell sizes vary with layout and building architecture. Portables use only one Common Air Interface (CAI) radio protocol within a cell; if both IS-136 and IS-54B portables operate in the same cell, all of them use the IS-54B protocol.

cell boundary value

A signal strength value specified as the minimum acceptable level for radio coverage by a specific Microcellular Base Station. During site planning this value is used to locate the outer edge of the coverage area for each cell.

cellco

See *cellular company*.

Cellco Mobility Control Point

See *CMCP*.

cellular

Mobility systems using radio techniques that provide wide coverage by splitting regions into cells and having adjacent cells use different frequencies. Includes both macrocellular and microcellular systems.

cellular company

A cellular (operating) company holds a license to operate and control cellular equipment within a certain geographical region, using a defined range of frequencies. The cellular company must provide the frequencies that the Microcellular system uses. Operation of the Microcellular system continues only if a link is maintained between the Microcellular system and the CMCP. The cellular company can change the frequency allocation at any time.

cellular service provider

See *cellular company*.

CMCP

Cellco Mobility Control Point. A MAT-based application that provides the cellular company with control over the use of frequencies by the Microcellular systems within its licensed region. Communicates with the MNCP (Meridian 1 Network Control Point) through a modem (PPP) connection.

Common Air Interface (CAI)

A uniform set of radio protocols. See also *IS-54B*, *IS-136*, and *IS-641*.

Core

See *Meridian 1 Core software*.

coverage area

The zone in which a portable telephone user should be able to make and receive calls. It can include stairwells, elevators, and so on.

deregistration

The process of disabling a portable telephone from working on a wireless system.

directory number

See *DN*.

distributed antenna system

A collection of antennas located throughout a cell.

DLC

Digital Line Card, a Meridian 1 card that gives the AFP software on the local MSM MAT access to AFP Stations as if they were Meridian 1 sets.

DN

Directory Number. A number that a Meridian 1 system can assign to a single telephone or to multiple telephones, such as a portable telephone and a wireline set.

downlink

The signal path for MBS to portable communication, in a forward channel.

Dual 8-Port Hybrid

The Dual 8-Port Hybrid is a combiner/splitter with MBS-to-hybrid input ports and hybrid-to-antenna output ports on both sides. See also *Quad 4-Port Hybrid*.

EFRC

Enhanced Full Rate Codec. See also *ACELP* and *IS-641*.

Embedded Intelligent Mobility Controller (EIMC)

The EIMC, an IPE circuit card, is the Microcellular system's wireless controller. This hardware pack is responsible for Layer 2 and Layer 3 processing as well as handoffs between different Microcellular Base Stations.

ESN

Electronic Serial Number/Electronic Switched Network. Each portable in a Microcellular system has an ESN that the system uses to locate the portable. A wireline set can share an ESN with a portable. See also *MIN*.

feature code string

A character string that a portable user enters to invoke or cancel a feature. See also *Mobility Feature Code* and *Mobility Special Prefix*.

forward channel

A forward channel in a cell is for MBS to portable communication, using a downlink.

handoff

A feature within wireless systems that allows portables to be moved about while continuing to receive uninterrupted service. The system moves a call from one traffic channel to another, either within the same cell, to improve reception (“interference handoff”), or to the traffic channel of another cell, to allow mobility (“mobility handoff”). Also called “handover.”

heartbeat

Periodic signal between the CMCP and the Microcellular system.

hybrid

A combiner/splitter with MBS-to-hybrid input ports and hybrid-to-antenna output ports. See also *Dual 8-Port Hybrid* and *Quad 4-Port Hybrid*.

interzone handoff

A handoff that occurs between cells of two different zones. See also *handoff*.

Intrazone handoff

A handoff that occurs from one cell to another cell within the same zone. See also *handoff*.

IPE

Intelligent peripheral equipment. Microcellular cards are installed on an IPE shelf in a Meridian 1 system.

IS-54B

Cellular System Dual-Mode Mobile Station—Base Station Compatibility Standard. IS-54B is a Common Air Interface (CAI) radio protocol that defines the interface for TDMA-3 and AMPS, with an analog control channel.

IS-136

Cellular System Dual-Mode Mobile Station—Base Station Compatibility Standard. IS-136 is a Common Air Interface (CAI) radio protocol that defines the interface for TDMA-3/VSELP and AMPS or TDMA-3/ACELP and AMPS, with either an analog control channel or a digital control channel. See also *ACELP* and *VSELP*.

IS-641

Cellular System Dual-Mode Mobile Station—Base Station Compatibility Standard. IS-641 is a Common Air Interface (CAI) radio protocol that defines the TDMA-3 ACELP implementation to incorporate EFRC into IS-136 systems. See also *ACELP*, *EFRC*, and *IS-136*.

ISDN

Integrated Services Digital Network. Switched digital network providing telephone company signaling information and user voice and data services over the same digital transmission and switching facilities.

MAT

Meridian Administration Tool. A MAT running Mobility System Management (MSM) is required for installation, operation, administration, and maintenance of the Microcellular system. A local MSM MAT connects to a Meridian 1 system through Ethernet, and a remote distributor MSM MAT can also connect to the Meridian 1 system. The CMCP application runs on a MAT. See also *Automatic Frequency Planning* and *Mobility System Management*.

MBS

See *Microcellular Base Station*.

MCU

Meridian Communications Unit, which gives the AFP application, running on the local MSM MAT, access to AFP Stations as if they were Meridian 1 handsets.

Meridian 1 Core software

The software components that reside on the CPU card, including the existing Meridian 1 software (Core Features) and the Mobility Service Provider

(MSP), the Core MSP, the Core Mobility Set Model, Core Mobility Switching, the MISP Interface Handler, and the Object Request Broker.

MFCO

See *Mobility Feature Code*.

microcell

Cells and cellular systems using low-power base stations with smaller cell sizes, in either public or private domains. A cellular operating company must provide the frequencies that these systems use.

Microcellular Base Station (MBS)

The fixed part of a Microcellular system that is used to communicate with portable telephones using a radio interface. An MBS in a Microcellular system supports up to 4 TRU-Is, each of which can independently operate as a control-channel radio or a traffic-channel radio (dual-mode TDMA-3 voice/AMPS data).

Microcellular Transcoder Card (MXC)

The MXC provides transcoding of voice within the Microcellular system and can support ACELP/VSELP voice coding or VSELP voice coding. See also *ACELP* and *VSELP*.

MIN

Mobile Identification Number. An MIN together with an ESN identifies each portable in a Microcellular system. See also *ESN*.

MISP

See *Multipurpose ISDN Signaling Processor*.

mobile station

A part of a cellular system that you can use while in motion, such as a portable handset or headset.

Mobility Feature Code

A sequence of digits that a portable user enters to invoke a specific dial-access function.

Mobility Special Prefix

A customer-defined number of up to four digits that the portable user enters, instead of a SPRE code, to activate a dial-access feature. A Mobility Special Prefix code can include the digits 0-9 and the asterisk. The default code is an asterisk (*).

Mobility System Management (MSM)

An application that runs on a MAT for installation, operations, administration, and maintenance of a Microcellular system.

Multipurpose ISDN Signaling Processor (MISP)

A Meridian 1 card, on an Option 51C, 61C, 81, or 81C system, that provides a communications interface between the Core Processor and peripheral devices. An MISP supplies routing and message relay between the Meridian 1 Call Processor (CP) card and to up to 8 EIMCs.

MXC

See *Microcellular Transcoder Card*.

partition

See *cell*.

PBX

Private Branch Exchange. A telephone system, owned by and installed on the premises of a business customer for use with an attendant console.

portable

Any Microcellular wireless set (portable telephone). A portable is the equivalent of an IS-136 or IS-54B “mobile station.”

The Microcellular system is designed for class 3 and 4 portables, which have a power output of 600 mwatts. (Class 1 portables, used as car phones, have a power output of 3 watts. Class 2 portables have a power output of 1.2 watts.

PPP

Point-to-Point protocol.

PRI

(ISDN) Primary Rate Interface having 23B + D format. Its digital trunk interface is at 1.5 Mbps.

primary surge protector

A voltage surge protector connected between each line conductor and ground located where telecommunications conductors enter a building structure. See also *supplemental power surge protector*.

PSDL

Peripheral software downLoad. Refers to reading computer programs or data that is related to peripheral equipment into a CPU.

PSTN

Public Switched Telephone Network. Consists of a location for customer equipment, a local loop, a local exchange area, interexchange transmission media, and a network switching area.

PSU

Power Supply Unit.

Quad 4-Port Hybrid

The Quad 4-Port Hybrid is a combiner/splitter with four MBS-to-hybrid input ports on one side and four hybrid-to-antenna output ports on the other side. See also *Dual 8-Port Hybrid*.

radio

See *TRU-II*.

Radio Line Card

See *Microcellular Transcoder Card*.

registration

The process in which a mobile station (portable) informs the system of its presence in a cell and requests permission to use the system's services. Includes both initial registration (upon entering a cell) and location registration (when moving between cells).

reverse channel

A reverse channel in a cell is for portable to MBS communications, using an uplink.

RF

Radio frequency, a frequency of the electromagnetic spectrum normally associated with radio wave propagation, usually above 150 kHz.

roaming

The ability of Microcellular system subscribers to be served by systems outside of their home system while still having many of the same capabilities that they would have in their home system (as opposed to call delivery, which refers to terminating a call to the subscriber regardless of location).

RPI

Remote Power Interconnect Unit, either RPI8 or RPI16.

RSSI

Received Signal Strength Indicator.

secondary power surge protector

See supplemental power surge protector.

SID

System identifier, a numeric or alphanumeric SID identifies the Meridian 1 system that includes the Microcellular system.

site planning

The process of positioning the Microcellular Base Stations, antennas, and other hardware in the system to maximize coverage for the portable telephones and minimize the number of Microcellular Base Stations required for acceptable performance. For detailed information on site planning, see the *Nortel COMPANION Microcellular Site planning and deployment guide* (553-3611-105).

supplemental power surge protector

A series-connected overcurrent protector, with optional voltage surge protection, located between a primary protector and the equipment. See also *primary power surge protector*.

TCM

Time Compression Multiplexing, which combines two or more information channels into a single transmission channel by assigning each information channel an exclusive, but short, periodic-transmission time interval.

TCM cable

Single twisted pairs of wires that provide a loop interface between an MBS, AFP Station, or MCU and a Meridian 1 system.

TCP/IP

Transmission Control Protocol/Internet Protocol. Set of protocols designed to link a variety of computers over different types of networks; a four-layer transmission system.

TDMA

Time Division Multiple Access. Used for through-the-air transmission used by cellular telephone systems.

TDMA-3

Uses TDMA Digital Traffic Channels with paired timeslots to provide three full-rate traffic channels per pair of transmit/receive RF channels (for example, 13 kb/s user data, 16.2 kb/s gross, in each direction).

transcoder

A device that converts between two different coding schemes. See also *Microcellular Transcoder Card*.

TRU-II

Transmit Receive Unit II, a radio in a Microcellular Base Station. A TRU-II provides both the Tx and Rx RF channels for a single duplex link (control channel or traffic channel). Two Rx paths provide antenna diversity.

uplink

The signal path for portable to MBS communications, in a reverse channel.

VSELP

Vector Sum Excited Linear Predictive, a method of TDMA-3 voice coding implemented in the IS-136 protocol. See also *ACELP* and *IS-136*.

wireline set

Any telephone set whose operation requires a physical connection from the set.

zone

A group of cells that a single EIMC controls, including the geographical area that the cells cover.

zone controller

The EIMC that controls a zone.

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See AFP Station.

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Algebraic Code Excited Linear Predictive

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cellco

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